2004 Atlantic Mackerel, *Loligo, Illex* and Butterfish Specifications Draft Environmental Assessment Regulatory Impact Review Initial Regulatory Flexibility Analysis EFH Assessment

October 2003

Mid-Atlantic Fishery Management Council
300 South New Street
Dover, DE 19904-6790
(302) 674-2331

Executive Summary

The Mid-Atlantic Fishery Management Council (Council) manages 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) through the Atlantic Mackerel, Squid, and Butterfish FMP (FMP). The FMP outlines the requirements of the Council to set annual specifications for the Atlantic mackerel, squid and butterfish fisheries according to national standards specified in the SFA. These fisheries are managed through annual quotas which are based principally on National Standard one which requires that fishing mortality rates not exceed guidelines established in the SFA. The Council made 2004 recommendations for specifications at its June 2003 meeting and herein submits them to the Regional Administrator, Northeast Region, National Marine Fisheries Service (Regional Administrator). This document not only serves as a vehicle for the Council's formal submission of recommendations for 2004 specifications, but also contains analyses upon which the recommendations are based. The Environmental Assessment is written in response to requirements of the National Environmental Policy Act.

The proposed specifications under the preferred alternative for *Loligo*, *Illex* and butterfish represent the status quo in terms of the proposed annual quotas (alternative 1) . For *Loligo*, the Council is proposing to specify the annual quota for a period of up to three years (i.e., 2004 - 2007). However, the Council will review all available information relative to *Loligo* annually and could change the *Loligo* quota if new data becomes available. The Council also recommended that the non-moratorium bycatch allowance for *Illex* be increased in 2004 to 10,000 pounds per trip when the directed fishery is open. Under the preferred alternative for Atlantic mackerel (Alternative 2) , the recommended ABC specification remains unchanged from the 2003 specification. However, the Council recommended that the joint venture specification be reduced to 5,000 mt in 2004 (otherwise the mackerel specifications are unchanged). The Council also recommended that if research projects are approved by December 31, 2003, up to 3% of ABC, IOY, DAH and DAP for 2004 may be set-aside for *Loligo* and *Illex* and up to 2% of IOY may be set-aside for scientific research for Atlantic mackerel and butterfish. The anticipated impacts on the environment for each alternative are summarized in Table ES-1 below.

Table ES-1. Qualitative summary of the expected impacts of various quota specifications considered for 2004 compared to the status quo. A plus sign (+) signifies an expected positive impact , minus sign (-) signifies an expected negative impact and a zero (0) is used for null impact.

	Environmental Dimension				
	Biological	Economic	Social	Protected Resources	Essential Fish Habitat
Alternative 1 - Atlantic mackerel (IOY=185,000 mt; JVP=10,000 mt)	0	0	0	0	0
Alternative 1- *Loligo* (IOY=17,000 mt)	0	0	0	0	0
Alternative 1- *Illex* (IOY=24,000 mt)	0	0	0	0	0
Alternative 1- butterfish (IOY=5,900 mt)	0	0	0	0	0
Alternative 2- Atlantic mackerel (IOY=170,000 mt; JVP=50,000 mt)	0	0	0	0	0
Alternative 2- *Loligo* (IOY=18,300 mt)	0	0	0	-	-
Alternative 2- *Illex* (IOY=30,000 mt)	-	-	-	-	-
Alternative 2- butterfish (IOY=10,000 mt)	-	-	-	-	-
Alternative 3- Atlantic mackerel (IOY=134,000 mt; JVP=0 mt)	0	-	-	0	0
Alternative 3- *Loligo* (IOY=13,000 mt)	^	-	-	^	^
Alternative 3- *Illex* (IOY=19,000 mt)	0	-	-	0	0
Alternative 3- butterfish (IOY=7,200 mt)	-	-	-	-	-

TABLE OF CONTENTS

DRAFT ENVIRONMENTAL ASSESSMENT FOR THE 2004 CATCH SPECIFICATIONS FOR ATLANTIC MACKEREL, SQUID, AND BUTTERFISH

1.0 Annual Specification Process

1.1 Introduction

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.

The term IOY is used in this fishery to reinforce the fact that the Regional Administrator may alter this specification up to the ABC if economic and social conditions warrant an increase. Therefore, this specification is no different than OY or optimum yield. No reserves are permitted under the FMP for any of these species. Procedures for determining the initial annual amounts are found in §648.21. They were most recently modified in Amendment 5 to the FMP.

Amendment 5 specified that the Atlantic Mackerel, Squid, and Butterfish Monitoring Committee will annually review the best available data including, but not limited to, commercial and recreational catch/landing statistics, current estimates of fishing mortality, stock status, the most recent estimates of recruitment, VPA results, target mortality levels, beneficial impacts of size/mesh regulations, as well as the level of noncompliance by fishermen or States and recommend to the Council Committee commercial (annual quota, minimum fish size, and minimum mesh size) and recreational (possession and size limits and seasonal closures) measures designed to assure that the target harvest level (OY) for Atlantic mackerel, squid, or butterfish is not exceeded. The Council receives the report of the Committee and then makes its recommendations to the Regional Administrator.

1.2 Purpose and Need

The Mid-Atlantic Fishery Management Council (Council) considered the 2004 recommendations for specifications at its June 2003 meeting and herein submits them to the Regional Administrator, Northeast Region, National Marine Fisheries Service (Regional Administrator). This document, entitled "2004 Atlantic Mackerel, *Loligo, Illex* and Butterfish Specifications, Environmental Assessment, Regulatory Impact Review, Initial Regulatory Flexibility Analysis and EFH Assessment" was submitted to the Regional Administrator in August 2003. This document not only serves as a vehicle for the Council's formal submission of recommendations for 2004 specifications, but also contains analyses upon which the recommendations are based. This Environmental Assessment is written in response to the FMP for this fishery, which requires the Council to set annual specifications for the Atlantic mackerel, squid and butterfish fisheries as analyzed in the FMP and according to national standards.

1.3 Management objectives of the FMP

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.

2.0 Methods of Analysis

The basic approach adopted in this analysis is an assessment of various management measures from the standpoint of determining the impacts upon the environment. In order to conduct a more complete analysis, impacts were examined for three alternatives for each species. The first alternative examines the measures that represent the 2003 status quo measures for all four species. In the case of *Loligo*, *Illex*, and butterfish , alternative 1 was also the preferred alternative adopted by the Council for 2004. The second alternative examines the impacts of the preferred alternative for Atlantic mackerel, and also represented the least restrictive alternative for all four species. The third alternative examines the lowest quotas (most restrictive alternative) considered by the Council for Atlantic mackerel, *Loligo* and *Illex*. A full description of these alternatives is given below in Section 3.0.

3.0 Alternatives Being Considered

The alternatives described below were selected based on the evaluation of a range of quota specifications which correspond to biologically based reference points (as specified in the FMP) and various assumptions about stock status. In all cases, the quota recommended by the Council under the preferred alternative for each species is based on the yield or level of catch associated with the overfishing definition specified in the FMP, as modified by relevant economic or social factors. These yield estimates are based on the national standard benchmark of maximum sustainable yield as specified in the SFA, as modified in the FMP to lower "target" level to assure that the overfishing threshold is not exceeded. Additional alternatives to the target yield levels specified in the FMP that were examined included changes/reductions from the reference level yield based on assumptions about current stock size or other factors such as economic considerations or reductions to the allowable yield to account for discard mortality.

3.1 Alternative 1 (2003 status quo (No Action - status quo alternative for each species and preferred alternative for *Loligo*, *Illex* and butterfish; least restrictive for Atlantic mackerel)

3.1.1 Alternative 1 for Atlantic mackerel (No Action - 2003 status quo and least restrictive alternative)

The specifications under this alternative would be ABC = 347,000 mt, IOY=185,000 mt, DAH=185,000 mt, DAP=150,000 mt and JVP=10,000 and TALFF=0 mt. They represent the 2003 status quo and least restrictive alternative for Atlantic mackerel.

3.1.2 Alternative 1 for *Loligo* (No action -2003 status quo and 2004 preferred alternative)

The specifications under this alternative would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 17,000 mt and JVP and TALFF = 0 mt. In terms of the annual quota, these specifications represent the 2003 status quo (No Action - status quo). They were also adopted as the preferred alternative by the Council for 2004. In addition, Framework 2 to the FMP added a provision to allow for the specification of management measures for multiple years for *Loligo*. Therefore, the

Council recommended that these specifications be maintained for 2004-2006, unless they are changed in the future during the annual quota setting procedure or by an in-season adjustment.

The Council also recommended that allocation of the annual quota in 2004-2006 remain the same as in 2002 and 2003. The quota allocations among quarters will be as follows: Quarter 1: 5,649.1 mt (33.23%), Quarter 2: 2,993.7 mt, (17.61%),Quarter 3: 2,941 mt (17.3 %),Quarter 4: 5,416.2 mt (31.86 %). In addition, the Council recommended for Quarters 1 through 3, that the directed fishery be closed when 80% of the quarter's allocation is taken and that vessels be restricted to a 2,500 pound trip limit for the remainder of the quarter. In addition, the Council recommended that quarterly overages be deducted as follows: an overage in quarter 1 will be deducted from quarter 3 and an overage in quarter 2 will be deducted from quarter 4. Underages from quarters 2 and 3 are to be added to quarter 4 by default based on the 95% closure rule for the annual quota. When 95% of the total annual quota has been taken (i.e, 16,150 mt) the trip limit will be reduced to 2,500 pounds and will in remain in effect for the rest of the fishing year. In the 2002 specifications, if the first quarter landings were less than 70% of the first quarter allocation, the underage below 70% of the quarter was to be applied to quarter 3. The Council recommended that this be increased to 80% in 2003 and that this provision be maintained in 2004-2006.

3.1.3 Alternative 1 for *Illex* (No action- 2003 status quo with minor change and 2004 preferred alternative)

The specifications under this alternative would be Max OY, ABC, IOY, DAH, and DAP = 24,000 mt and JVP and TALFF = 0 mt. These recommended specifications remain unchanged from the 2003 specifications and thus represent the status quo. They were also adopted as the preferred alternative by the Council for 2004. In addition, the Council recommended that the non-moratorium bycatch allowance for *Illex* be increased to 10,000 pounds per trip when the directed fishery is open.

3.1.4 Alternative 1 for butterfish (No action- 2003 status quo and 2004 preferred alternative)

The specifications under this alternative would be Max OY = 16,000 mt, ABC = 7,200 mt, and IOY, DAH, and DAP = 5,900 mt and JVP and TALFF = 0 mt. These recommended specifications remain unchanged from the 2003 specifications and thus represent the status quo. They were also adopted as the preferred alternative by the Council for 2004.

3.2 Alternative 2 (Preferred alternative for Atlantic mackerel and least restrictive alternative for each species except Atlantic mackerel)

3.2.1 Alternative 2 for Atlantic mackerel (preferred alternative)

The specifications under the preferred alternative for Atlantic mackerel in 2004 would be ABC = 347,000 mt, IOY=170,000 mt, DAH=170,000 mt, DAP=150,000 mt, JVP=5,000 mt and TALFF=0 mt. In addition, it is the Council's intent that the sum of JVP and the amount of mackerel landed under Internal Waters Processing (IWP) operations not exceed the total JVP specification. That is, the amount of mackerel taken by US vessels and transferred over the side to foreign vessels, whether in state or federal waters, should not exceed the amount specified for JVP. This was the preferred alternative adopted by the Council for Atlantic mackerel for 2004. In addition, Council recommend the following special provisions: 1) joint ventures are allowed south of 37^{o} 30' N. latitude, but the river herring bycatch south of that latitude may not exceed 0.25% of the over the side transfers of Atlantic mackerel 2) the Regional Administrator should do everything within his/her power to reduce impacts on marine mammals in prosecuting the Atlantic mackerel fisheries 3) the mackerel OY may be increased during the year, but the total should not exceed 347,000 mt and 4) applications from a particular foreign nation for a mackerel Joint Venture allocation in 2004 may be decided based on an evaluation by the Regional Administrator of the nation's performance relative to purchase obligations for previous years.

3.2.2 Alternative 2 for *Loligo* (least restrictive alternative)

The specifications under this alternative would be Max OY =20,000 mt, ABC, IOY, DAH, and DAP = 18,300 mt and JVP and TALFF = 0 mt. These specifications are consistent with recommendations of SARC-30 which considered the current *Loligo* overfishing definition to be inappropriate for a short-lived species. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for *Loligo* which was considered by the Council.

3.2.3 Alternative 2 for *Illex* (least restrictive alternative)

The specifications under this alternative would be Max OY, ABC, IOY, DAH, and DAP = 30,000 mt and JVP and TALFF = 0 mt. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for *Illex* which was considered by the Council.

3.2.4 Alternative 2 for butterfish (least restrictive alternative)

The specifications under this alternative would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 10,000 mt and JVP and TALFF = 0 mt. This set of specifications for butterfish is consistent with overfishing definition, but not with the most recent assessment advice for butterfish. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for butterfish which was considered by the Council.

3.3 Alternative 3 (most restrictive alternative for Atlantic mackerel, *Loligo*, and *Illex*)

3.3.1 Alternative 3 for Atlantic mackerel: Specify ABC at long term potential catch (most restrictive)

The third alternative action considered by the Council for Atlantic mackerel in 2004 was to specify ABC at long term potential catch. The most recent estimate of LTPC was 134,000 mt. Therefore, the specifications under this alternative would be ABC=134,000 mt, IOY=134,000 mt, DAH=134,000 mt, DAP=119,000 mt and JVP=0 and TALFF=0 mt.

3.3.2 Alternative 3 for *Loligo* (most restrictive alternative)

The specifications under this alternative would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 13,000 mt and JVP and TALFF = 0 mt. These specifications are consistent with recommendations of SARC-26 which considered the *Loligo* stock to be below the spawning stock threshold or ½ B_{msy}. This represents the most restrictive alternative considered by the Council.

3.3.3 Alternative 3 for *Illex* (most restrictive alternative)

The specifications under this alternative would be Max OY =24,000 mt, ABC, IOY, DAH, and DAP = 19,000 mt and JVP and TALFF = 0 mt. This represents the most restrictive alternative considered by the Council.

3.3.4 Alternative 3 for butterfish

The specifications under this alternative would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 7,200 mt and JVP and TALFF = 0 mt.

4.0 Affected Environment

The principal area within which the Atlantic mackerel, squid and butterfish fisheries are prosecuted is the Northeast Shelf Ecosystem which includes the area from the Gulf of Maine south to Cape Hatteras, extending from the coast seaward to the edge of the continental shelf, including the slope sea offshore to the Gulf Stream. A number of distinct subsystems comprise the region, including the Gulf of Maine, Georges Bank, and Mid-Atlantic Bight. The Gulf of Maine is an enclosed coastal sea, characterized by relatively cold waters and deep basins, with a patchwork of various sediment types. Georges Bank is a relatively shallow coastal plateau that slopes gently from north to south and has steep submarine canyons on its eastern and southeastern edge. It is characterized by highly productive, well-mixed waters and fast-moving currents. The Mid-Atlantic Bight is comprised of the sandy, relatively flat, gently sloping continental shelf from southern New England to Cape Hatteras, NC.

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. 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 ºF in the New York Bight in February to over 80 ºF 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.

4.1 Description of EFH

As defined in section 3 (10) of the MSFCMA, EFH is "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." NMFS interprets "waters" to include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

Matrices of habitat parameters (i.e. temperature, salinity, light, etc.) for eggs/larvae and juveniles/adults were developed in the Atlantic mackerel, *Loligo* and *Illex* squid and butterfish EFH background documents which were included in Amendment 8. In addition, Amendment 8 identified and described essential fish habitat for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish in section 2.2.2 and is summarized below.

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 ºF and 73 ºF.

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 Port and Community Description

The Council contracted with Dr. Bonnie McCay and her associates at Rutgers University to describe the ports and communities that are associated with the Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries. The researchers provide a complete description of the ports and communities dependent upon Atlantic mackerel, *Loligo* and *Illex* squid and butterfish in Appendix 1.

In addition to the detailed description in Appendix 1, the ports and communities which are dependent on these species are also described below in section 5 of this EA. The landings of Atlantic mackerel by port in 2002 are described in section 5.1.3.1.2. In descending order of importance, the following ports accounted for the majority of Atlantic mackerel landings in 2002: Cape May, NJ, Portsmouth, RI, North Kingstown, RI , and Gloucester, MA. Two ports were dependent on Atlantic mackerel for more than 10% of the value of total fishery landings in 2002- Portsmouth, RI and North Kingstown, RI. The landings of *Loligo* by port in 2002 are described in section 5.2.3.2. Point Judith, RI accounted for about 30% of the *Loligo* landings in 2002. Other important ports in terms of *Loligo* landings included Hampton Bay, NY, Montauk, NY, Cape May, NJ, Newport, RI and North Kingstown, RI. There were 11 ports that were dependent on *Loligo* for more than 10% of the value of total fishery landings in those ports in 2002. The landings of *Illex* by port in 2002 are are described in section 5.3.3.2. North Kingstown, RI accounted for greater than 70 % of the *Illex* landings in 2002. Other important ports in terms of *Illex* landings included Point Judith, RI , Cape May, NJ, and Elizabeth, NJ. North Kingstown, RI was the only port that was dependent on *Illex* for more than 10% of the value of total fishery landings in 2002. The landings of butterfish by port in 2002 are described in section 5.4.3.2. Two Rhode Island ports, Port Judith and Montauk, NY accounted for more than half of the butterfish landings in 2002. Other important ports in terms of butterfish landings included Hampton Bay, NY, and New Port, RI. There were no ports that were dependent on butterfish for more than 10% of the value of total fishery landings in 2002.

4.3 Description of Protected Resources

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

Cetaceans

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

Sea Turtles

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

Fish

Species	Status
Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered
Atlantic salmon (*Salmo salar*)	Endangered

Birds

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

Critical Habitat Designations

Species	Area
Right whale	Cape Cod Bay

Description of Species Listed as Endangered which inhabit the management unit of the FMP

North Atlantic Right Whale

Right whales have occurred historically in all the world's oceans from temperate to subarctic latitudes. NMFS recognizes three major subdivisions of right whales: North Pacific, North Atlantic, and Southern Hemisphere. NMFS further recognizes two extant subunits in the North Atlantic: eastern and western (Waring *et al.* 2002). A third subunit may have existed in the central Atlantic (migrating from east of Greenland to the Azores or Bermuda), but this stock appears to be extinct (Perry *et al.* 1999).

The north Atlantic right whale has the highest risk of extinction among all of the large whales in the worlds oceans. The scarcity of right whales is the result of an 800-year history of whaling that continued into the 1960s (Klumov 1962). Historical records indicate that right whales were subject to commercial whaling in the North Atlantic as early as 1059. Between the 11th and 17th centuries, an estimated 25,000-40,000 right whales may have been harvested. The size of the western north Atlantic right whale population at the termination of whaling is unknown, but the stock was recognized as seriously depleted as early as 1750. However, right whales continued to be taken in shore-based operations or opportunistically by whalers in search of other species as late as the 1920's. By the time the species was internationally protected in 1935, there may have been fewer than 100 western north Atlantic right whales in the western Atlantic (Hain 1975; Reeves *et al.* 1992; Kenney *et al.* 1995 in Waring *et al.* 2002).

NMFS designated right whale critical habitat on June 3, 1994 (59 FR 28793) to help protect important right whale foraging and calving areas within the U.S. These include the waters of

Cape Cod Bay and the Great South Channel off the coast of Massachusetts, and waters off the coasts of southern Georgia and northern Florida. In 1993, Canada's Department of Fisheries declared two conservation areas for right whales; one in the Grand Manan Basin in the lower Bay of Fundy, and a second in Roseway Basin between Browns and Baccaro Banks (Canadian Recovery Plan for the North Atlantic Right Whale 2000).

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.* 2002). A Recovery plan has been published and currently 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).

The western North Atlantic population of right whales was estimated to be 291 individuals in 1998 (Waring *et al.* 2002). The best available information makes it reasonable to conclude that the current death rate exceeds the birth rate in the western North Atlantic right whale population. The nearly complete reproductive failure in this population from 1993 to 1995 and again in 1998 and 1999 suggests that this pattern has continued for almost a decade, though the 2000/2001 season appears the most promising in the past 5 years, in terms of calves born. Because no population can sustain a high death rate and low birth rate indefinitely, this combination places the North Atlantic right whale population at high risk of extinction. Coupled with an increasing calving interval, the relatively large number of young right whales (0-4 years) and adults that are killed, by human-related factors, the likelihood of extinction is high. The recent increase in births gives rise to optimism, however these young animals must be provided with protection so that they can mature and contribute to future generations in order to be a factor in stabilizing of the population.

Right whales may be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including the operation of commercial fisheries. However, the major known sources of anthropogenic mortality and injury of right whales clearly are ship strikes and entanglement in commercial fishing gear. Waring *et al.* (2002) give a detailed description of the annual human related mortalities of right whales.

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. Humpback whales calve and mate in the West Indies and migrate to feeding areas in the northwestern Atlantic during the summer months. Six separate feeding areas are utilized in northern waters after their return (Waring *et al.* 2002). Only one of these feeding areas, the GOM, lies within U.S. waters and is within the action area of this consultation. Most of the humpbacks that forage in the GOM visit Stellwagen Bank and the waters of Massachusetts and Cape Cod Bays. Sightings are most frequent from mid-March through November between 41º N and 43º N, from the Great South Channel north along the outside of Cape Cod to Stellwagen Bank and Jeffreys Ledge (CeTAP 1982), and peak in May and August. Small numbers of individuals may be present in this area year-round. They feed on a number of species of small schooling fishes, particularly sand lance and Atlantic herring, by targeting fish schools and filtering large amounts of water for their associated prey. Humpback whales have also been observed feeding on krill (Wynne and Schwartz 1999).

New information has recently become available on the status and trends of the humpback whale population in the North Atlantic. Although current and maximum net productivity rates are unknown at this time, the population is apparently increasing. It has not yet been determined whether this increase is uniform across all six feeding stocks (Waring *et al.* 2002). For example, the overall rate of increase has been estimated at 9.0% (CV=0.25) by Katona and Beard (1990), while a 6.5% rate was reported for the Gulf of Maine by Barlow and Clapham (1997) using data through 1991. The rate reported by Barlow and Clapham (1997) may roughly approximate the rate of increase for the portion of the population within the action area.

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the lognormally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for Gulf of Maine humpback whales is 902 (CV=0.41). The minimum population estimate for this stock is 647 (Waring *et al.* 2002).

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 647 . The maximum productivity rate is the default value of 0.04. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.10 because this stock is listed as an endangered species under the Endangered Species Act (ESA). PBR for the Gulf of Maine humpback whale stock is 1.3 whales (Waring *et al.* 2002).

The major known sources of anthropogenic mortality and injury of humpback whales include entanglement in commercial fishing gear and ship strikes. Based on photographs of the caudal peduncle of humpback whales, Robbins and Mattila (1999) estimated that at least 48% --- and possibly as many as 78% --- of animals in the Gulf of Maine exhibit scarring caused by entanglement. Several whales have apparently been entangled on more than one occasion. These estimates are based on sightings of free-swimming animals that initially survive the encounter. Because some whales may drown immediately, the actual number of interactions may be higher. In addition, the actual number of species-gear interactions is contingent on the intensity of observations from aerial and ship surveys.

For the period 1996 through 2000, the total estimated human-caused mortality and serious injury to the Gulf of Maine humpback whale stock is estimated as 3.0 per year (USA waters, 2.4; Canadian waters, 0.6). This average is derived from two components: 1) incidental fishery interaction records, 2.8 (USA waters, 2.2; Canadian waters, 0.6); and 2) records of vessel collisions, 0.2 (USA waters, 0.2; Canadian waters, 0). There were additional humpback mortalities and serious injuries that occurred in the southeastern and mid-Atlantic states that could not be confirmed as involving members of the Gulf of Maine stock (Waring *et al.* 2002). These records represent an additional minimum annual average of 1.6 human-caused mortalities and serious injuries to humpbacks over the time period, of which 1.0 per year are attributable to incidental fishery interactions and 0.6 per year are attributable to vessel collisions (Waring *et al.* 2002).

Humpback whales may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including the operation of commercial fisheries.

Fin Whale

Fin whales inhabit a wide range of latitudes between 20-75/ N and 20-75/ S (Perry *et al.* 1999). Fin whales spend the summer feeding in the relatively high latitudes of both hemispheres, particularly along the cold eastern boundary currents in the North Atlantic and North Pacific Oceans and in Antarctic waters (IWC 1992). Most migrate seasonally from relatively high-latitude Arctic and Antarctic feeding areas in the summer to relatively low-latitude breeding and calving areas in the winter (Perry *et al.* 1999).

Various estimates have been provided to describe the current status of fin whales in western North Atlantic waters. Based on the catch history and trends in Catch Per Unit Effort, an estimate of 3,590 to 6,300 fin whales was obtained for the entire western North Atlantic (Perry *et al.* 1999). Hain *et al.* (1992) estimated that about 5,000 fin whales inhabit the Northeastern United States continental shelf waters. The latest (Waring *et al.* 2001) SAR gives a best estimate of abundance for fin whales of 2,814 (CV = 0.21). The minimum population estimate for the western North Atlantic fin whale is 2,362. This is currently an underestimate, as too little is known about population structure, and the estimate is derived from surveys over a limited portion of the western North Atlantic. There is also not enough information to estimate population trends. The NMFS has designated one stock of fin whale for U.S. waters of the North Atlantic (Waring *et al.* 1998) where the species is commonly found from Cape Hatteras northward.

The major known sources of anthropogenic mortality and injury of fin whales include ship strikes and entanglement in commercial fishing gear. However, many of the reports of mortality cannot be attributed to a particular source. Of 18 fin whale mortality records collected between 1991 and 1995, four were associated with vessel interactions, although the proximal cause of mortality was not known. The following injury/mortality events are those reported from 1996 to the present for which source was determined. These numbers should be viewed as absolute minimum numbers; the total number of mortalities and injuries cannot be estimated but is believed to be higher since it is unlikely that all carcasses will be observed. In general, known mortalities of fin whales are less than those recorded for right and humpback whales. This may be due in part to the more offshore distribution of fin whales where they are either less likely to encounter entangling gear, or are less likely to be noticed when gear entanglements or vessel strikes do occur.

Fin whales may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including the operation of commercial fisheries. The fin whale was listed as endangered throughout it's range on June 2, 1970 under the ESA.
Hain *et al.* (1992) estimated that about 5,000 fin whales inhabit the northeastern United States continental shelf waters. Waring *et al.* 2002 present a more recent estimate of 2,814 (CV=0.21) fin whales based on aerial and shipboard surveys of the area from Georges Bank to the mouth of the Gulf of S. Lawrence in 1999.

Sei Whale

Sei whales are a widespread species in the world's temperate, subpolar and subtropical and even tropical marine waters. However, they appear to be more restricted to temperate waters than other balaenopterids (Perry *et al.* 1999). The IWC recognized three stocks in the North Atlantic based on past whaling operations as opposed to biological information: (1) Nova Scotia; (2) Iceland Denmark Strait; (3) Northeast Atlantic (Donovan 1991 *in* Perry *et al.* 1999). Mitchell and Chapman (1977) suggested that the sei whale population in the western North Atlantic consists of two stocks, a Nova Scotian Shelf stock and a Labrador Sea stock. The Nova Scotian Shelf stock includes the continental shelf waters of the northeastern United States, and extends northeastward to south of Newfoundland. The IWC boundaries for this stock are from the U.S. east coast to Cape Breton, Nova Scotia and east to longitude 42/ (Waring *et al.* 2000). This is the only sei whale stock within the action area.

Sei whales winter in warm temperate or subtropical waters and summer in more northern latitudes. In the northern Atlantic, most births occur in November and December when the whales are on the wintering grounds. Conception is believed to occur in December and January. Gestation lasts for 12 months and the calf is weaned at 6-9 months when the whales are on the summer feeding grounds (Draft Recovery Plan, NMFS 1998a). Sei whales reach sexual maturity at 5-15 years of age. The calving interval is believed to be 2-3 years (Perry *et al.* 1999).
Sei whales occur in deep water throughout their range, typically over the continental slope or in basins situated between banks (Draft Recovery Plan, NMFS 1998a). In the northwest Atlantic, the whales travel along the eastern Canadian coast in autumn, June and July on their way to and from the Gulf of Maine and Georges Bank where they occur in winter and spring. Within the action area, the sei whale is most common on Georges Bank and into the Gulf of Maine/Bay of Fundy region during spring and summer, primarily in deeper waters. Individuals may range as far south as North Carolina. It is important to note that sei whales are known for inhabiting an area for weeks at a time then disappearing for year or even decades; this has been observed all over the world, including in the southwestern GOM in 1986. The basis for this phenomenon is not clear.

There are insufficient data to determine trends of the sei whale population. Because there are no abundance estimates within the last 10 years, a minimum population estimate cannot be determined for NMFS management purposes (Waring *et al.* 2002). Abundance surveys are problematic not only because this species is difficult to distinguish from the fin whale but more significant is that too little is known of the sei whale's distribution, population structure and patterns of movement; thus survey design and data interpretation are very difficult.

Few instances of injury or mortality of sei whales due to entanglement or vessel strikes have been recorded in U.S. waters. Entanglement is not known to impact this species in the U.S. Atlantic, possibly because sei whales typically inhabit waters further offshore than most commercial fishing operations, or perhaps entanglements do occur but are less likely to be observed. A small number of ship strikes of this species have been recorded. The most recent documented incident occurred in 1994 when a carcass was brought in on the bow of a container ship in Charlestown, Massachusetts. Other impacts noted above for other baleen whales may also occur. Due to the deep-water distribution of this species, interactions that do occur are less likely to be observed or reported than those involving right, humpback, and fin whales that often frequent areas within the continental shelf (Waring *et al.* 2002).

Blue Whale

Like the fin whale, blue whales occur worldwide and are believed to follow a similar migration pattern from northern summering grounds to more southern wintering areas (Perry *et al.* 1999). Three subspecies have been identified: *Balaenoptera musculus musculus, B.m. intermedia*, and *B.m. brevicauda* (NMFS 1998c). Only *B. musculus* occurs in the northern hemisphere. Blue whales range in the North Atlantic extends from the subtropics to Baffin Bay and the Greenland Sea (Aecium and Leatherwood 1985). The IWC currently recognizes these whales as one stock (Perry *et al.* 1999).

Blue whales are only occasional visitors to east coast U.S. waters. They are more commonly found in Canadian waters, particularly the Gulf of St. Lawrence where they are present for most of the year, and other areas of the North Atlantic. It is assumed that blue whale distribution is governed largely by food requirements (NMFS 1998b). In the Gulf of St. Lawrence, blue whales appear to predominantly feed on *Thysanoessa raschii* and *Meganytiphanes norvegica*. In the eastern North Atlantic, *T. inermis* and *M. norvegica* appear to be the predominant prey (NMFS 1998b).

Compared to the other species of large whales, relatively little is known about this species. Sexual maturity is believed to occur in both sexes at 5-15 years of age. Gestation lasts 10-12 months and calves nurse for 6-7 months. The average calving interval is estimated to be 2-3 years. Birth and mating both take place in the winter season (NMFS. 1998c), but the location of wintering areas is speculative (Perry *et al.* 1999). In 1992 the U.S. Navy and contractors conducted an extensive blue whale acoustic survey of the North Atlantic and found concentrations of blue whales on the Grand Banks and west of the British Isles. One whale was tracked for 43 days during which time it traveled 1,400 nautical miles around the general area of Bermuda (Perry *et al.* 1999).

Entanglement in fishing gear and ship strikes are believed to be the major sources of anthropogenic mortality and injury of blue whales. However, confirmed deaths or serious injuries from either are few. In 1987, concurrent with an unusual influx of blue whales into the Gulf of Maine, one report was received from a whale watch boat that spotted a blue whale in the southern Gulf of Maine entangled in gear described as probable lobster pot gear. A second animal found in the Gulf of St. Lawrence apparently died from the effects of an entanglement. In March 1998, a juvenile male blue whale was carried into Rhode Island waters on the bow of a tanker. The cause of death was determined to be due to a ship strike, although not necessarily caused by the tanker on which it was observed, and the strike may have occurred outside the U.S. EEZ (Waring *et al.* 2002). No recent entanglements of blue whales have been reported from the U.S. Atlantic. Other impacts noted above for other baleen whales may occur.

Sperm Whale

Sperm whales inhabit all ocean basins, from equatorial waters to the polar regions (Perry *et al.* 1999). In the western North Atlantic they range from Greenland to the Gulf of Mexico and the Caribbean. The sperm whales that occur in the western North Atlantic are believed to represent only a portion of the total stock (Blaylock *et al.* 1995). Total numbers of sperm whales off the USA or Canadian Atlantic coast are unknown, although eight estimates from selected regions of the habitat do exist for select time periods. The best estimate of abundance for the North Atlantic stock of sperm whales is 4,702 (CV=0.36) (Waring *et al.* 2002). The minimum population estimate for the western North Atlantic sperm whale is 3,505 (CV=0.36). Sperm whales present in the Gulf of Mexico are considered by some researchers to be endemic, and represent a separate stock from whales in other portions of the North Atlantic. However, NMFS currently uses the IWC stock structure guidance which recognizes one stock for the entire North Atlantic (Waring *et al.* 2002).

Sperm whales generally occur in waters greater than 180 meters in depth. While they may be encountered almost anywhere on the high seas, their distribution shows a preference for continental margins, sea mounts, and areas of upwelling, where food is abundant (Leatherwood and Reeves 1983). Sperm whales in both hemispheres migrate to higher latitudes in the summer for feeding and return to lower latitude waters in the winter where mating and calving occur. Mature males typically range to much higher latitudes than mature females and immature animals but return to the lower latitudes in the winter to breed (Perry *et al.* 1999). Waring *et al.* (1993) suggest sperm whale distribution is closely correlated with the Gulf Stream edge. Like swordfish, which feed on similar prey, sperm whales migrate to higher latitudes during summer months, when they are concentrated east and northeast of Cape Hatteras. In the U.S. EEZ, sperm whales occur on the continental shelf edge, over the continental slope, and into the mid-ocean regions (Waring *et al.* 1993), and are distributed in a distinct seasonal cycle; concentrated east-northeast of Cape Hatteras in winter and shifting northward in spring when whales are found throughout the mid-Atlantic Bight. Distribution extends further northward to areas north of Georges Bank and the Northeast Channel region in summer and then south of New England in fall, back to the mid-Atlantic Bight (Waring *et al.* 2000).

Few instances of injury or mortality of sperm whales due to human impacts have been recorded in U.S. waters. Because of their generally more offshore distribution and their benthic feeding habits, sperm whales are less subject to entanglement than are right or humpback whales. Documented takes primarily involve offshore fisheries such as the offshore lobster pot fishery and pelagic driftnet and pelagic longline fisheries. The NMFS Sea Sampling program recorded three entanglements (in 1989, 1990, and 1995) of sperm whales in the swordfish drift gillnet fishery prior to permanent closure of the fishery in January 1999. All three animals were injured, found alive, and released. However, at least one was still carrying gear. Opportunistic reports of sperm whale entanglements for the years 1993-1997 include three records involving offshore lobster pot gear, heavy monofilament line, and fine mesh gillnet from an unknown source. Sperm whales may also interact opportunistically with fishing gear. Observers aboard Alaska sablefish and Pacific halibut longline vessels have documented sperm whales feeding on longline caught fish in the Gulf of Alaska (Perry *et al.* 1999). Behavior similar to that observed in the Alaskan longline fishery has also been documented during longline operations off South America where sperm whales have become entangled in longline gear, have been observed feeding on fish caught in the gear, and have been reported following longline vessels for days (Perry *et al.* 1999).

Sperm whales are also struck by ships. In May 1994 a ship struck sperm whale was observed south of Nova Scotia (Waring *et al.* 2002). A sperm whale was also seriously injured as a result of a ship strike in May 2000 in the western Atlantic. Due to the offshore distribution of this species, interactions that do occur are less likely to be reported than those involving right, humpback, and fin whales that more often occur in nearshore areas. Other impacts noted above for baleen whales may also occur.

Due to their offshore distribution, sperm whales tend to strand less often than, for example, right whales and humpbacks. Preliminary data for 2000 indicate that of ten sperm whales reported to the stranding network (nine dead and one injured) there was one possible fishery interaction, one ship strike (wounded with bleeding gash on side) and eight animals for which no signs of entanglement or injury were sighted or reported. No sperm whales have stranded or been reported to the stranding network as of February 2001.

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 2000), conducting an assessment of the status of the loggerhead sea turtle population in the Western North Atlantic (WNA), concluded that there are at least four loggerhead subpopulations separated at the nesting beach in the WNA (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 (1998) 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 TEWG (1998) reported nest number at around 6,200 (TEWG 1998). More recently, the addition of nesting data from the years 1996, 1997 and 1998, did not change the assessment of the TEWG that the number of loggerhead nests in the Northern Subpopulation is stable or declining (TEWG 2000). Since the number of nests 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.

Leatherback Sea Turtle

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

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

Leatherbacks are predominantly a pelagic species and feed on jellyfish (i.e., *Stomolophus, Chryaora*, and *Aurelia* (Rebel 1974)), cnidarians (medusae, siphonophores) and tunicates (salps, pyrosomas). Time-Depth-Recorder data recorded by Eckert *et al.* (1998b) indicate that leatherbacks are night feeders and are deep divers, with recorded dives to depths in excess of 1000 meters. However, leatherbacks may come into shallow waters if there is an abundance of jellyfish nearshore. Leary (1957) reported a large group of up to 100 leatherbacks just offshore of Port Aransas, Texas associated with a dense aggregation of Stomolophus. Leatherbacks also occur annually in places such as Cape Cod and Narragansett Bays during certain times of the year, particularly the fall.

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

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

Leatherback interactions with the southeast shrimp fishery are also common. Turtle Excluder Devices (TEDs), typically used in the southeast shrimp fishery to minimize sea turtle/fishery interactions, are less effective for the large-sized leatherbacks. Therefore, the NMFS has used several alternative measures to protect leatherback sea turtles from lethal interactions with the shrimp fishery. These include establishment of a Leatherback Conservation Zone (60 FR 25260). NMFS established the zone to restrict, when necessary, shrimp trawl activities from off the coast of Cape Canaveral, Florida to the Virginia/North Carolina Border. It allows the NMFS to quickly close the area or portions of the area to the shrimp fleet on a short-term basis when high concentrations of normally pelagic leatherbacks are recorded in more coastal waters where the shrimp fleet operates. Other emergency measures may also be used to minimize the interactions between leatherbacks and the shrimp fishery. For example, in November 1999 parts of Florida experienced an unusually high number of leatherback strandings. In response, the NMFS required shrimp vessels operating in a specified area to use TEDs with a larger opening for a 30-day period beginning December 8, 1999 (64 FR 69416) so that leatherback sea turtles could escape if caught in the gear.

Leatherbacks are also susceptible to entanglement in lobster and crab pot gear, possibly as a result of attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, attraction to the buoys which could appear as prey, or the gear configuration which may be more likely to wrap around flippers. The total number of leatherbacks reported entangled from New York through Maine from all sources for the years 1980 - 2000 is 119; out of this total, 92 of these records took place from 1990-2000. Entanglements are also common in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line and crab pot line. It is unclear how leatherbacks become entangled in such gear. Prescott (1988) reviewed stranding data for Cape Cod Bay and concluded that for those turtles where cause of death could be determined (the minority), entanglement in fishing gear is the leading cause of death followed by capture by dragger, cold stunning, or collision with boats.

Spotila *et al.* (1996) describe a hypothetical life table model based on estimated ages of sexual maturity at both ends of the species' natural range (5 and 15 years). The model concluded that leatherbacks maturing in 5 years would exhibit much greater population fluctuations in response to external factors than would turtles that mature in 15 years. Furthermore, the simulations indicated that leatherbacks could maintain a stable population only if both juvenile and adult survivorship remained high, and that if other life history stages (i.e., egg, hatchling, and juvenile) remained static. Model simulations indicated that an increase in adult mortality of more than 1% above background levels in a stable population was unsustainable. As noted, there are many human-related sources of mortality to leatherbacks; a tally of all leatherback takes anticipated annually under current biological opinions completed for the NMFS June 30, 2000, biological opinion on the pelagic longline fishery projected a potential for up to 801 leatherback takes, although this sum includes many takes expected to be nonlethal. Leatherbacks have a number of pressures on their populations, including injury or mortality in fisheries, other Federal activities (e.g., military activities, oil and gas development, etc.), degradation of nesting habitats, direct harvest of eggs, juvenile and adult turtles, the effects of ocean pollutants and debris, lethal collisions, and natural disturbances such as hurricanes (which may wipe out nesting beaches).

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

Estimated to number approximately 115,000 adult females globally in 1980 (Pritchard 1982) and only 34,500 by 1995 (Spotila *et al.* 1996), leatherback populations have been decimated worldwide, not only by fishery related mortality but, at least historically, primarily due to intense exploitation of the eggs (Ross 1979). On some beaches nearly 100% of the eggs laid have been harvested (Eckert 1996). Eckert (1996) and Spotila *et al.* (1996) record that adult mortality has also increased significantly, particularly as a result of driftnet and longline fisheries. Spotila (2000) states that a conservative estimate of annual leatherback fishery-related mortality (from longlines, trawls and gillnets) in the Pacific during the 1990s is 1,500 animals. He estimates that this represented about a 23% mortality rate (or 33% if most mortality was focused on the East Pacific population).

Nest counts are currently the only reliable indicator of population status available for leatherback turtles. The status of the leatherback population in the Atlantic is difficult to assess since major nesting beaches occur over broad areas within tropical waters outside the United States. Recent information suggests that Western Atlantic populations declined from 18,800 nesting females in 1996 (Spotila *et al.* 1996) to 15,000 nesting females by 2000. Eastern Atlantic (i.e., off Africa, numbering ~ 4,700) and Caribbean (4,000) populations appear to be stable, but there is conflicting information for some sites and it is certain that some nesting populations (e.g., St. John and St. Thomas, U.S. Virgin Islands) have been extirpated (NMFS and USFWS 1995). It does appear, however, that the Western Atlantic portion of the population is being subjected to mortality beyond sustainable levels, resulting in a continued decline in numbers of nesting females.

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). More recently the TEWG (2000) concluded that the Kemp's Ridley population appears to be in the early stages of exponential expansion. While the number of females nesting annually is estimated to be orders of magnitude less than historical levels, the mean rate of increase in the annual number of nests has accelerated over the period 1987-1999. Preliminary analyses suggest that the intermediate recovery goal of 10,000 nesting females by 2020 may be achievable (TEWG 2000).

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.

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

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).

Atlantic salmon

The recent ESA-listing for Atlantic salmon covers the wild population of Atlantic salmon found in rivers and streams from the lower Kennebec River north to the U.S.-Canada border. These include the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers and Cove Brook. Atlantic salmon are an anadromous species with spawning and juvenile rearing occurring in freshwater rivers followed by migration to the marine environment. Juvenile salmon in New England rivers typically migrate to sea in May after a two to three year period of development in freshwater streams, and remain at sea for two winters before returning to their U.S. natal rivers to spawn from mid October through early November. While at sea, salmon generally undergo an extensive northward migration to waters off Canada and Greenland. Data from past commercial harvest indicate that post-smolts overwinter in the southern Labrador Sea and in the Bay of Fundy. The numbers of returning wild Atlantic salmon within the Gulf of Maine Distinct Population Segment (DPS) are perilously small with total run sizes of approximately 150 spawners occurring in 1999 (Baum 2000). Although capture of Atlantic salmon has occurred in commercial fisheries (usually otter trawl or gillnet gear) or by research/survey, no salmon have been reported captured in the Atlantic mackerel, squid and butterfish fisheries.

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.

Fishery Classification under Section 118 of Marine Mammal Protection Act

Under section 118 of the MMPA , the NMFS must publish and annually update the List of Fisheries (LOF), which places all US commercial fisheries in one of three categories based on the level of incidental serious injury and mortality of marine mammals in each fishery (arranging them according to a two tiered classification system). The categorization of a fishery in the LOF determines whether participants in that fishery may be required to comply with certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The classification criteria consists of a two tiered, stock-specific approach that first addresses the total impact of all fisheries on each marine mammal stock (Tier 1) and then addresses the impact of the individual fisheries on each stock (Tier 2). If the total annual mortality and serious injury of all fisheries that interact with a stock is less than 10% of the 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 I fishery in the List of Fisheries for 2003 for the taking of marine mammals by commercial fishing operations under section 118 of the Marine Mammal Protection Act (MMPA) of 1972. The Atlantic Squid, Mackerel, Butterfish Trawl Fishery was previously NMFS classified as a Category II fishery.   This 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 exceeds 10% of the PBR (78, 184, and 107 respectively). Therefore, the Atlantic Squid, Mackerel, Butterfish Trawl Fishery was subject to Tier 2 analysis. Waring et *al* 2002 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 elevated this fishery to Category I. Since this fishery has become a Category I fishery under MMPA, it will receive a high priority with respect to observer coverage and consideration for measures under future Take Reduction Plans for any of the species listed above.   NMFS intends on convening a Take Reduction Team in the summer of 2006 to reduce the take of these species in the Atlantic trawl fisheries, including the Atlantic mackerel, squid, and butterfish fishery.

Description of species of concern which are protected under MMPA

The following is a description of species of concern because they are protected under MMPA and, as discussed above, have had documented interactions with fishing gears used to harvest species managed under this FMP.

Common dolphin

The common dolphin may be one of the most widely distributed species of cetaceans, as it is found worldwide in temperate, tropical, and subtropical seas. In the North Atlantic, common dolphin appear to be present along the coast over the continental shelf along the 200-

300m isobaths or over prominent underwater topography from 50/ N to 40/S latitude (Evans 1994; Waring *et al.* 2002). The species is less common south of Cape Hatteras, although schools have been reported as far south as eastern Florida (Gaskin 1992). Common dolphins are distributed along the continental slope (100 to 2,000 meters), and are associated with Gulf Stream features in waters off the northeastern USA coast (CETAP 1982; Selzer and Payne 1988; Waring *et al.* 1992). They are widespread from Cape Hatteras northeast to Georges Bank (35º to 42º North latitude) in outer continental shelf waters from mid-January to May (Hain *et al.* 1981; CETAP 1982; Payne *et al.* 1984). Common dolphins move northward onto Georges Bank and the Scotian Shelf from mid-summer to autumn (Palka *et al.* in review). Selzer and Payne (1988) reported very large aggregations (greater than 3,000 animals) on Georges Bank in autumn. Common dolphins are rarely found in the Gulf of 1,000 m. Maine, where temperature and salinity regimes are lower than on the continental slope of the Georges Bank/mid-Atlantic region (Selzer and Payne 1988). Migration onto the Scotian Shelf and continental shelf off Newfoundland occurs during summer and autumn when water temperatures exceed 11/C (Sergeant *et al.* 1970; Gowans and Whitehead 1995; Waring *et al.* 2002).

Total numbers of common dolphins off the USA or Canadian Atlantic coast are unknown, although five estimates from selected regions of the habitat do exist for select time periods. Sightings were almost exclusively in the continental shelf edge and continental slope areas (Figure 1). An abundance of 29,610 common dolphins (CV=0.39) was estimated from an aerial survey program conducted from 1978 to 1982 on the continental shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). An abundance of 22,215 (CV=0.40) common dolphins was estimated from a June and July 1991 shipboard line transect sighting survey conducted primarily between the 200 and 2,000m isobaths from Cape Hatteras to Georges Bank (Waring *et al.* 1992; Waring 1998). As recommended in the GAMS Workshop Report (Wade and Angliss 1997), estimates 66older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates (Waring *et al.* 2002).

An abundance of 1,645 (CV=0.47) common dolphins was estimated from a June and July 1993 shipboard line transect sighting survey conducted principally between the 200 and 2,000 m isobaths from the southern edge of Georges Bank, across the Northeast Channel to the southeastern edge of the Scotian Shelf (Anon. 1993). Data were collected by two alternating teams that searched with 25x150 binoculars and were analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993). Estimates include school size-bias, if applicable, but do not include corrections for g(0) or dive-time. Variability was estimated using bootstrap resampling techniques.

An abundance of 6,741 (CV=0.69) common dolphins was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (Waring *et al.* 2002). Total track line length was 32,600 km. The ships covered waters between the 50 and 1000 fathom depth contour lines, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the mid-Atlantic from the coastline to the 50 fathom depth contour line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom depth contour line. Data collection and analysis methods used were described in Palka (1996).

An abundance of 30,768 (CV=0.32) common dolphins was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38/ N) (Figure 1; Palka *et al.* in review).

Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and g(0), the probability of detecting a group on the track line. Aerial data were not corrected for g(0). No common dolphins were encountered during the SEFSC component of the joint surveys. That shipboard line transect sighting survey was conducted between 8 July and 17 August 1998 and surveyed 5,570 km of track line in waters south of Maryland (38/N) (Mullin in review). Although the 1991, 1993, 1995, and 1998 surveys did not sample the same areas or encompass the entire common dolphin habitat (e.g., little effort in Scotian shelf edge waters), they did focus on segments of known or suspected high-use habitats off the northeastern USA coast. The 1993, 1995, and 1998 data suggest that, seasonally, at least several thousand common dolphins are occupying continental shelf edge waters, with perhaps highest abundance in the Georges Bank region (Waring *et al.* 2002).

The best available abundance estimate for common dolphins is 30,768 (CV=0.32) as estimated from the July 6 to September 6, 1998 USA Atlantic surveys. This estimate is considered best because these surveys have the most complete coverage of the species' habitat. The previous best estimate of 22,215 (CV=0.40) is nearly eight years old. The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the lognormally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for common dolphins is 30,768 (CV=0.32). The minimum population estimate for the western North Atlantic common dolphin is 23,655 (CV=0.32). There are insufficient data to determine the population trends for this species (Waring *et al.* 2002).

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 23,655 (CV=0.32). The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.48 because the CV of the average mortality estimate is between 0.3-0.6 (Wade and Angliss 1997), and because this stock is of unknown status. PBR for the western North Atlantic common dolphin is 227 (Waring *et al.* 2002).

Fishery Interactions

Total annual estimated average fishery-related mortality or serious injury to this stock during 1996-2000 was 375 common dolphins (CV=0.40; Waring *et al.* 2002). Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet (DWF) activities off the northeast coast of the USA. With implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA), an observer program was established which has recorded fishery data and information of incidental bycatch of marine mammals. DWF effort in the Atlantic coast Exclusive Economic Zone (EEZ) under MFCMA has been directed primarily towards Atlantic mackerel and squid. From 1977 through 1982, an average of 120 different foreign vessels per year (range 102-161) operated within the US Atlantic EEZ. In 1982, there were 112 different foreign vessels; 16%, or 18, were Japanese tuna longline vessels operating along the USA east coast. This was the first year that the Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels. Between 1983 and 1991, the numbers of foreign vessels operating within the US Atlantic EEZ each year were 67, 52, 62, 33, 27, 26, 14, 13, and 9, respectively. Between 1983 and 1988, the numbers of DWF vessels included 3, 5, 7, 6, 8, and 8, respectively, Japanese longline vessels. Observer coverage on DWF vessels was 25-35% during 1977-1982, and increased to 58%, 86%, 95%, and 98%, respectively, in 1983-1986. From 1987-91, 100% observer coverage was maintained. Foreign fishing operations for squid and mackerel ceased at the end of the 1986 and 1991 fishing seasons, respectively .

During the period 1977-1986, observers recorded 123 mortalities in foreign Loligo squid-fishing activities (Waring *et al.* 1990). In 1985 and 1986, Italian vessels took 56 and 54 animals, respectively, which accounts for 89% (n = 110) of the total takes in foreign Loligo squid-fishing operations. No mortalities were reported in foreign Illex squid fishing operations. Because of spatial/temporal fishing restrictions, most of the bycatch occurred along the continental shelf edge (100 m) isobath during winter (December to February).

From 1977-1991, observers recorded 110 mortalities in foreign mackerel-fishing operations (Waring *et al.*1990; NMFS unpublished data). This total includes one documented take by a USA vessel involved in joint-venture fishing operations in which USA captains transfer their catches to foreign processing vessels. The bycatch occurred during winter/spring (December to May).

Data on current incidental takes in USA fisheries are available from several sources. In 1986, NMFS established a mandatory self-reported fisheries information system for large pelagic fisheries. Data files are maintained at the Southeast Fisheries Science Center (SEFSC). The Northeast Fisheries Science Center (NEFSC) Sea Sampling Observer Program was initiated in 1989, and since that year several fisheries have been covered by the program. In late 1992 and in 1993, the SEFSC provided observer coverage of pelagic longline vessels fishing off the Grand Banks (Tail of the Banks) and provides observer coverage of vessels fishing south of Cape Hatteras.

Bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet, pelagic pair trawl, pelagic longline fishery, mid-Atlantic coastal gillnet, North Atlantic bottom trawl, Northeast multispecies sink gillnet, and Atlantic squid, mackerel, butterfish trawl fisheries (Waring *et al.* 2003).

The mid-Atlantic mackerel and squid trawl fisheries were combined into the Atlantic mid-water trawl fishery in the revised proposed list of fisheries in 1995. The fishery occurs along the USA mid-Atlantic continental shelf region between New Brunswick, Canada, and Cape Hatteras year around. The mackerel trawl fishery was classified as a Category II fishery since 1990 and the squid fishery was originally classified as a Category II fishery in 1990, but was reclassified as a Category III fishery in 1992. The combined fishery was reclassified as a Category II fishery in 1995. In 1996, mackerel, squid, and butterfish trawl fisheries were combined into the Atlantic squid, mackerel, and butterfish trawl fishery, and maintained a Category II classification. As noted above, the NMFS elevated this fishery to Category I in the 2001 LOF. The Observer coverage, expressed as number of trips, was < 1% from 1996-2000. Three common dolphin mortalities were observed in 1996, 1 in 1997, 0 in 1998, 1 in 1999, and 6 in 2000. The 1996 and 2000 mortalities were in the Loligo squid fishery and the 1997 mortality occurred in the Atlantic mackerel fishery. The estimated annual fishery-related mortality and serious injury attributable to this fishery (CV in parentheses) was 940 in 1996 (0.75), 161 in 1997 70 (0.49), 0 in 1998, 49 in 1999 (0.78), and 235 in 2000 (0.57). Average annual estimated fishery-related mortality attributable to this fishery during 1996-2000 was 285 common dolphins (CV= 0.51). However, these estimates should be viewed with caution due to the extremely low (<1%) observer coverage and uncertainties regarding number of vessels participating in this "fishery". In addition, a USA joint venture fishery was conducted in the mid-Atlantic region from February-May 1998. NMFS, maintained 100% observer coverage on the foreign joint venture vessels. One hundred and fifty-two transfers from the USA vessels were observed. Seventeen common dolphin mortalities were observed in March. The principal fish species in the transferred trawl nets and number of bycaught animals (in parentheses) were: squid (11), butterfish (4), and mackerel (2). Average annual estimated fishery-related mortality attributable to this fishery in 1998 was 17 common dolphins (CV=0) (Waring *et al.* 2003).

The status of common dolphins, relative to OSP, in the US Atlantic EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this species. The total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. This is a strategic stock because the1996-2000 average annual fishery-related mortality and serious injury exceeds PBR (Waring *et al.* 2003).

White-sided dolphin (*Lagenorhynchus acutus*)

White-sided dolphins are found in temperate and sub-polar waters of the North Atlantic, primarily on continental shelf waters to the 100 m depth contour. The species inhabits waters from central west Greenland to North Carolina (about 35o N) and perhaps as far east as 43° W (Evans 1987). Distribution of sightings, strandings and incidental takes suggest the possible existence of three stocks units: a Gulf of Maine, a Gulf of St. Lawrence and a Labrador Sea stock (Palka *et al.* 1997). A genetic study is currently being conducted to test this proposed population structure and should be available during 2002. Evidence for a separation between the well documented unit in the southern Gulf of Maine and a Gulf of St. Lawrence population comes from a hiatus of summer sightings along the Atlantic side of Nova Scotia. This has been reported in Gaskin (1992), is evident in Smithsonian stranding records, and was seen during abundance surveys conducted in summers 1995 and 1999 that covered waters from Virginia to the entrance of the Gulf of St. Lawrence. White-sided dolphins were seen frequently in eastern Gulf of Maine waters and in waters at the mouth of the Gulf of St. Lawrence, but only a few sightings were recorded in the waters between these two regions (Waring *et al.* 2002).

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

The total number of white-sided dolphins along the eastern USA and Canadian Atlantic coast is unknown, although five estimates from select regions are available: 1) from spring, summer and autumn 1978-82; 2) July-September 1991-92; 3) June-July 1993; 4) July-September 1995 (Figure 1); and 5) July-August 1999. An abundance of 28,600 white-sided dolphins (CV=0.21) was estimated from an aerial survey program conducted from 1978 to 1982 on the continental shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982).

An abundance of 20,400 (CV=0.63) white-sided dolphins was estimated from two shipboard line transect surveys conducted during July to September 1991 and 1992 in the northern Gulf of Maine-lower Bay of Fundy region (Palka *et al.* 1997). This population size is a weighted-average of the 1991 and 1992 estimates, where each annual estimate was weighted by the inverse of its variance. An abundance of 729 (CV= 0.47) white-sided dolphins was estimated from a June and July 1993 shipboard line transect sighting survey conducted principally between the 200 and 2,000 m isobaths from the southern edge of Georges Bank, across the Northeast Channel to the southeastern edge of the Scotian Shelf (Waring *et al.* 2002).

An abundance of 27,200 (CV=0.43) white-sided dolphins was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (Waring *et al.* 2002). Total track line length was 32,600 km. The ships covered waters between the 50 and 1000 fathom contour lines, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the mid-Atlantic from the coastline to the 50 fathom contour line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom contour line. Data collection and analysis methods used were described in Palka (1996). An abundance of 51,640 (CV=0.38) white-sided dolphins was estimated from a 28 July to 31 August 1999 line-transect sighting survey conducted from a ship and an airplane covering waters from Georges Bank to the mouth of the Gulf of St. Lawrence (Waring *et al.* 2002). Total track line length was 8,212 km. Similar to that used in the above 1995 survey, shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and g(0), the probability of detecting a group on the track line. Aerial data were not corrected for g(0) (Palka 2000). The 1999 estimate is larger than the 1995 estimate due to, at least in part, the fact that the 1999 survey covered the upper Bay of Fundy and the northern edge of Georges Bank for the first time and white-sided dolphins were seen. Kingsley and Reeves (1998) estimated there were 11,740 (CV=0.47) white-sided dolphins in the Gulf of St. Lawrence during 1995, and 560 (CV=0.89) white-sided dolphins in the northern Gulf of St. Lawrence during 1996 (Waring *et al.* 2002). It is assumed these estimates apply to the Gulf of St. Lawrence stock. During the 1995 survey, 8,427 km of track lines were flown in an area of 221,949 km2 during August and September. During the 1996 survey, 3,993 km of track lines were flown in an area of 94,665 km2 during July and August. Data were analyzed using Quenouille's jackknife bias reduction procedure on line transect methods that model the left truncated sighting curve (Waring *et al.* 2002). These estimates were uncorrected for visibility biases, such as g(0). The best available current abundance estimate for white-sided dolphins in the Gulf of Maine stock is 51,640 (CV=0.38) as estimated from the July to August 1999 line transect survey because this survey is recent and provided the most complete coverage of the known habitat (Waring *et al.* 2002).

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the lognormally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for the Gulf of Maine stock of whitesided dolphins is 51,640 (CV=0.38). The minimum population estimate for these white-sided dolphins is 37,904 (CV=0.38). There are insufficient data to determine population trends for this species (Waring *et al.* 2002).

Current and maximum net productivity rates are unknown for this stock. Life history parameters that could be used to estimate net productivity include: calving interval is 2-3 years; lactation period is 18 months; gestation period is 10-12 months and births occur from May to early August, mainly in June and July; length at birth is 110 cm; length at sexual maturity is 230-240 cm for males, and 201-222 cm for females; age at sexual maturity is 8-9 years for males and 6-8 years for females; mean adult length is 250 cm for males and 224 cm for females (Evans 1987); and maximum reported age for males is 22 years and for females, 27 years (Sergeant *et al.* 1980).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 37,904 (CV=0.38). The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.48 because this stock is of unknown status and the CV of the mortality estimate is between 0.3 and 0.6. PBR for the Gulf of Maine stock of the western North Atlantic whitesided dolphin is 364 (Waring *et al.* 2002).

Fishery Interactions

Recently, within USA waters, white-sided dolphins have been observed caught in the Northeast sink gillnet, mid-Atlantic coastal gillnet, pelagic drift gillnet, North Atlantic bottom trawl, and Atlantic squid, mackerel, butterfish trawl fisheries. Estimated average annual fishery-related mortality and serious injury to the Gulf of Maine stock of the western North Atlantic white-sided dolphin from these USA fisheries during 1996-2000 was 118 (CV=0.48) dolphins per year (Waring *et al.* 2002).

In the past, incidental takes of white-sided dolphins have been recorded in the Atlantic foreign mackerel fishery and pelagic drift gillnet fishery. In the mid 1980's, during a University of Maine study, gillnet fishermen reported 6 takes of white-sided dolphins of which 2 carcasses were necropsied for biological studies (Gilbert and Wynne 1987; Gaskin 1992). Atlantic foreign mackerel NMFS foreign fishery observers have reported 44 takes of Atlantic white-sided dolphins incidental to fishing activities in the continental shelf and continental slope waters between March 1977 and December 1991 (Waring *et al.* 1990; NMFS unpublished data). Of these animals, 96% were taken in the Atlantic mackerel fishery. This total includes 9 documented takes by USA vessels involved in joint-venture fishing operations in which USA captains transfer their catches to foreign processing vessels. Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet (DWF) activities off the northeast coast of the USA. With implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA) in that year, an observer program was established which recorded fishery data and information of incidental bycatch of marine mammals. DWF effort in the USA Atlantic Exclusive Economic Zone (EEZ) under MFCMA had been directed primarily towards Atlantic mackerel and squid. From 1977 through 1982, an average of 120 different foreign vessels per year (range 102-161) 106 operated within the US Atlantic EEZ. In 1982, there were 112 different foreign vessels; 16%, or 18, were Japanese tuna longline vessels operating along the USA east coast. This was the first year that the Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels. Between 1983 and 1991, the numbers of foreign vessels operating within the US Atlantic EEZ each year were 67, 52, 62, 33, 27, 26, 14, 13, and 9, respectively. Between 1983 and 1988, the numbers of DWF vessels included 3, 5, 7, 6, 8, and 8, respectively, Japanese longline vessels. Observer coverage on DWF vessels was 25-35% during 1977-82, and increased to 58%, 86%, 95%, 98%, respectively, in 1983-86 and 100% observer coverage was maintained during 1987-91. Foreign fishing operations for squid ceased at the end of the 1986 fishing season and for mackerel at the end of the 1991 season (Waring *et al.* 2002).

One white-sided dolphin was observed taken in the mackerel sub-fishery during 1997 (Waring *et* *al.* 2002). The squid, mackerel, butterfish trawl fishery, though managed under one FMP, is actually three independent fisheries operating in different areas during different times of the year (NMFS 1998). The *Loligo* squid sub-fishery is mostly in southern New England, New York and mid-Atlantic waters, where fishing patterns reflect the seasonal migration of the *Loligo* (offshore during October to March and inshore during April to September). The *Illex* squid sub-fishery is primarily on the continental slope during June to September. The mackerel sub-fishery during January to May is primarily in the southern New England and mid-Atlantic waters, while during May to December, it is primarily in the Gulf of Maine. Butterfish is primarily a bycatch of the squid and mackerel sub-fisheries. Butterfish migrate north and inshore during the summer, and south and offshore during the winter. In 1995, the squid, mackerel, butterfish trawl fishery was classified as a Category II fishery. As noted above, the NMFS elevated this fishery to Category I in the 2001 LOF. Observer coverage was very low. Expressed as percentage of trips observed, it was 0.7% in 1996, 0.8% in 1997, 0.3% in 1998, 0.4% in 1999, and 0.7% in 2000. The bycatch, stratified by subfishery, season and geographical area, was estimated using the ratio estimator method, as was documented in Bisack (1997b). The estimated fishery-related mortality was 0 in 1996, 161 (CV=1.58) in 1997, and 0 in 1998 to 2000. The average annual estimated fishery-related mortality during 1996 to 2000 was 32 (CV=1.58)(Waring *et al.* 2002) .

The status of white-sided dolphins, relative to OSP, in the US Atlantic EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this species. The total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. This is a non-strategic stock because estimated average annual fishery-related mortality and serious injury does not exceed PBR (Waring *et al.* 2002).

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

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

The long-finned pilot whale is distributed from North Carolina to North Africa (and the Mediterranean) and north to Iceland, Greenland and the Barents Sea (Sergeant 1962; Leatherwood *et al.* 1976; Abend 1993; Buckland *et al.* 1993). The stock structure of the North Atlantic population is uncertain (Anon. 1993a; Fullard *et al.* 2000). Recent morphometrics (Bloch and Lastein 1993) and genetics (Siemann 1994; Fullard *et al.* 2000) studies have provided little support for stock structure across the Atlantic (Fullard *et al.* 2000). However, Fullard *et al.* (2000) have proposed a stock structure that is correlated to sea surface temperature: 1) a cold-water population west of the Labrador/North Atlantic current and 2) a warm-water population that extends across the Atlantic in the Gulf Stream (Waring *et al.* 2002).

The short-finned pilot whale is distributed worldwide in tropical to warm temperate water (Leatherwood and Reeves 1983). The northern extent of the range of this species within the USA Atlantic Exclusive Economic Zone (EEZ) is generally thought to be Cape Hatteras, North Carolina (Leatherwood and Reeves 1983). Sightings of these animals in US Atlantic EEZ occur primarily within the Gulf Stream [Southeast Fisheries Science Center (SEFSC) unpublished data], and along the continental shelf and continental slope in the northern Gulf of Mexico (Mullin *et al.* 1991; SEFSC unpublished data). There is no information on stock differentiation for the Atlantic population (Waring *et al.* 2002).

The total number of short-finned pilot whales off the eastern USA and Canadian Atlantic coast is unknown, although ten estimates from selected regions of the habitat do exist for select time periods. Sightings were almost exclusively in the continental shelf edge and continental slope areas (Waring *et al.* 2002). Two estimates were derived from catch data and population models that estimated the abundance of the entire stock. Seven seasonal estimates are available from selected regions in USA waters during spring, summer and autumn 1978-82, August 1990, June-July 1991, August-September 1991, June-July 1993, July-September 1995, and July-August 1998. Because long-finned and short-finned pilot whales 100 m and 1,000 m. are difficult to identify at sea, seasonal abundance estimates were reported for Globicephala sp., both long-finned and short-finned pilot whales. One estimate is available from the Gulf of St. Lawrence. Mitchell (1974) used cumulative catch data from the 1951-61 drive fishery off Newfoundland to estimate the initial population size (ca. 50,000 animals). Mercer (1975), used population models to estimate a population in the same region of between 43,000- 96,000 long-finned pilot whales, with a range of 50,000-60,000 being considered the best estimate.

An abundance of 11,120 (CV=0.29) *Globicephala* sp. was estimated from an aerial survey program conducted from 1978 to 1982 on the continental shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). An abundance of 3,636 (CV=0.36) *Globicephala* sp. was estimated from a June and July 1991 shipboard line transect sighting survey conducted primarily between the 200 and 2,000 m isobaths from Cape Hatteras to Georges Bank (Waring *et al.* 1992; Waring 1998; Waring *et al.* 2002). An abundance of 3,368 (CV=0.28) and 139 5,377 (CV=0.53) *Globicephala* sp. was estimated from line transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11, respectively (Anon. 1991). As recommended in the GAMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, and therefore should not be used for PBR determinations. Further, due to changes in survey methodology, these data should not be used to make comparisons to more current estimates. An abundance of 668 (CV=0.55) Globicephala sp. was estimated from a June and July 1993 shipboard line transect sighting survey conducted principally between the 200 and 2,000 m isobaths from the southern edge of Georges Bank, across the Northeast Channel to the southeastern edge of the Scotian Shelf . Data were collected by two alternating teams that searched with 25x150 binoculars and were analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993). Estimates include school-size bias, if applicable, but do not include corrections for g(0) or dive-time. Variability was estimated using bootstrap resampling techniques. An abundance of 8,176 (CV=0.65) Globicephala sp. was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence. Total track line length was 32,600 km. The ships covered waters between the 50 and 1000 fathom depth contour lines, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the mid-Atlantic from the coastline tothe 50 fathom depth contour line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom depth contour line (Waring *et al.* 2002). Data collection and analysis methods used were described in Palka (1996). Kingsley and Reeves (1998) obtained an abundance estimate of 1,600 long-finned pilot whales (CV=0.65) from a late August and early September aerial survey of cetaceans in the Gulf of St. Lawrence in 1995 and 1998. Based on an examination of long-finned pilot whale summer distribution patterns and information on stock structure, it was deemed appropriate to combine these estimates with NMFS 1995 summer survey data. The best 1995 abundance estimate for Globicephala sp., 9,776 (CV=0.55), is the sum of the estimates from the USA and Canadian surveys, where the estimate from the USA survey is 8,176 (CV=0.65) and from the Canadian, 1,600 (CV=0.65) (Waring *et al.* 2002).

An abundance of 9,800 (CV=0.34) Globicephala sp. was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38/ N) (Waring *et al.* 2002). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and g(0), the probability of detecting a group on the track line. Aerial data were not corrected for g(0). An abundance of 4,724 (CV=0.61) Globicephala sp. was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 5,570 km of track line in waters south of Maryland (38/N) (Waring *et al.* 2002). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993) where school size bias and ship attraction were accounted for.

The best available abundance estimate for Globicephala sp., 14,524 (CV=0.30), is the sum of the estimates from the two 1998 USA Atlantic surveys, where the estimate from the northern USA Atlantic is 9,800 (CV=0.34) and from the southern USA Atlantic is 4,724 (CV=0.61) (Waring *et al.* 2002). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the lognormally distributed best abundance estimate (Waring *et al.* 2002). This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for Globicephala sp. is 14,524 (CV=0.30) (Waring *et al.* 2002). The minimum population estimate for Globicephala sp. is 11,343 (CV=0.30). There are insufficient data to determine the population trends for this species (Waring *et al.* 2002).

Current and maximum net productivity rates are unknown for this stock. For purposes of their assessment, Waring *et al.* 2002 assumed the maximum net productivity rate to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for Globicephala sp. is 11,343 (CV=0.30). The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be .48 because the CV of the average mortality estimate is between 0.3-0.6 (Wade and Angliss 1997), and because this stock is of unknown status. PBR for the western North Atlantic Globicephala sp. is 108 (Waring *et al.* 2002).

Fishery Interactions

Total fishery-related mortality and serious injury cannot be estimated separately for the two species of pilot whales in the US Atlantic EEZ because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that either species might have been subject to the observed fishery-related mortality and serious injury. Total annual estimated average fishery-related mortality or serious injury of this stock during 1996-2000 in the USA fisheries listed below was 193 pilot whales (CV=0.43) (Waring *et al.* 2002). The Canadian average annual mortality estimate for 1996 from the Nova Scotia trawl fisheries is 6 long-finned pilot whales. It is not possible to estimate variance of the Canadian estimate. The total average annual mortality estimate for 1996-2000 from the USA and Nova Scotia trawl fisheries is 199 (CV = 0.43) (Waring *et al.* 2002).

The level of past or current, direct, human-caused mortality of short-finned pilot whales in the US Atlantic EEZ is unknown. The short-finned pilot whale has been taken in the pelagic longline fishery in Atlantic waters off the southeastern USA (Lee *et al.* 1994; SEFSC unpublished data). Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet (DWF) activities off the northeast coast of the USA. A fishery observer program, which has collected fishery data and information on incidental bycatch of marine mammals, was established in 1977 with the implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA). DWF effort in the US Atlantic EEZ under MFCMA has been directed primarily towards Atlantic mackerel and squid. An average of 120 different foreign vessels per year (range 102-161) operated within the US Atlantic EEZ during 1977 through 1982. In 1982, there were 112 different foreign vessels; 18 (16%) were Japanese tuna longline vessels operating along the USA Atlantic coast. This was the first year that the Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels. The number of foreign vessels operating within the US Atlantic EEZ each year between 1983 and 1991 averaged 33 and ranged from 9 to 67. The number of Japanese longline vessels included among the DWF vessels averaged 6 and ranged from 3 to 8 between 1983 and 1988. MFCMA observer coverage on DWF vessels was 25-35% during 1977-82, increased to 58%, 86%, 95%, and 98%, respectively, during 1983-86, 141 and 100% observer coverage was maintained from 1987-91. Foreign fishing operations for squid ceased at the end of the 1986 fishing season and, for mackerel, at the end of the 1991 fishing season.

During 1977-1991, observers in this program recorded 436 pilot whale mortalities in foreign-fishing activities (Waring *et al.* 1990; Waring 1995). A total of 391 (90%) were taken in the mackerel fishery, and 41 (9%) occurred during Loligo and Illex squid-fishing operations. This total includes 48 documented takes by USA vessels involved in joint venture fishing operations in which USA captains transfer their catches to foreign processing vessels. Due to temporal fishing restrictions, the bycatch occurred during winter/spring (December to May) in continental shelf and continental shelf edge waters (Fairfield *et al.* 1993; Waring 1995); however, the majority of the takes occurred in late spring along the 100 m isobath. Two animals were also caught in both the hake fishery and tuna longline fisheries (Waring *et al.* 1990).

The distribution of long-finned pilot whale, a northern species, overlaps with that of the short-finned pilot whale, a predominantly southern species, between 35/30'N to 38/00'N (Leatherwood *et al.* 1976). Although long-finned pilot whales are most likely taken in the waters north of Delaware Bay, many of the pilot whale takes are not identified to species and bycatch does occur in the overlap area. In this summary, therefore, long-finned pilot whales (Globicephala melas) and unidentified pilot whales (Globicephala sp.) are considered together. Data on current incidental takes in USA fisheries are available from several sources. In 1986, NMFS established a mandatory self-reported fisheries information system for large pelagic fisheries. Data files are maintained at the Southeast Fisheries Science Center (SEFSC). The Northeast Fisheries Science Center (NEFSC) Sea Sampling Observer Program was initiated in 1989, and since that year several fisheries have been covered by the program. In late 1992 and in 1993, the SEFSC provided observer coverage of pelagic longline vessels fishing off the Grand Banks (Tail of the Banks) and provides observer coverage of vessels fishing south of Cape

Hatteras (Waring *et al.* 2002).

Bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, and pelagic pair trawl, bluefin tuna purse seine, North Atlantic bottom trawl, Atlantic squid, mackerel, butterfish trawl, and Mid- Atlantic coastal gillnet fisheries, but no mortalities or serious injuries have documented in the Northeast multispecies sink gillnet fishery .

The mid-Atlantic mackerel and squid trawl fisheries were combined into the Atlantic mid-water trawl fishery in the revised proposed list of fisheries in 1995. The fishery occurs along the USA mid-Atlantic continental shelf region between New Brunswick, Canada, and Cape Hatteras year around. The mackerel trawl fishery was classified as a Category II fishery since 1990 and the squid fishery was originally classified as a Category II fishery in 1990, but was reclassified as a Category III fishery in 1992. The combined fishery was then reclassified as a Category II fishery in 1995. In 1996, mackerel, squid, and butterfish trawl fisheries were combined into the Atlantic squid, mackerel, butterfish trawl fishery, and maintained a Category II classification until 2001 when they were reclassified as a Category I fishery. Three fishery-related mortalities of pilot whales were reported in self-reported fisheries information from the mackerel trawl fishery between 1990-1992. Six mortalities were observed in 1996, 1 in years 1998 and 1999 and 2 in 2000. The 1996 and 1998 bycatch occurred in the Illex squid fishery, and the 1999 in the *Loligo* fishery. The estimated fishery-related mortality to pilot whales in the USA Atlantic attributable to this fishery was: 45 in 1996 (CV=1.27), 0 in 1997, 85 in 1998 (CV=0.65), 49 in 1999 (CV=0.97) and 34 in 2000 (CV=0.65); average annual mortality between 1996 and 2000 was 43 pilot whales (CV=0.45). However, these estimates should be viewed with caution due to the extremely low (<1%) observer coverage.

Other Mortality

Pilot whales have a propensity to mass strand throughout their range, but the role of human activity in these events is unknown (Waring *et al.* 2002). Between 2 and 120 pilot whales have stranded annually either individually or in groups in NMFS Northeast Region (Anon. 1993b) since 1980. From 1992-2000, 98 long-finned pilot whale stranded between South Carolina and Maine, including 22 and 11 animals that mass stranded in 1992 and 2000, respectively, along the Massachusetts coast (NMFS unpublished data). Four of 6 animals from 1 live stranding event in Massachusetts in 2000 were rehabilitated and released. In addition 11 pilot whales that live stranded on Nantucket were returned to the water. In eastern Canada, 37 strandings of long-finned pilot whales (173 individuals) were reported on Sable Island, Nova Scotia from 1970-1998 (Lucas and Hooker 1997; Lucas and Hooker 2000). This included 130 animals that mass stranded in December 1976, and 2 smaller groups (<10 each) in autumn 1979 and summer 1992. Fourteen strandings were also recorded along Nova Scotia from 1991-1996 (Hooker *et al.* 1997). A potential human-caused source of mortality is from polychlorinated biphenyls (PCBs) and chlorinated pesticides (DDT, DDE, dieldrin, etc.) moderate levels of which have been found in pilot whale blubber (Taruski 1975; Muir *et al.* 1988; Weisbrod *et al.* 2000). Weisbrod *et al.* (2000) reported that bioaccumulation levels were more similar in whales from the same standing group than animals of the same sex or age. Also, high levels of toxic metals (mercury, lead, cadmium) and selenium were measured in pilot whales harvested in the Faroe Island drive fishery (Nielsen *et al.* 2000). Similarly, Dam and Bloch (2000) found very high PCB levels in pilot whales in the Faroes. The population effect of the observed levels of such contaminants is unknown (Waring *et al.* 2002).

The status of long-finned and short-finned pilot whales relative to OSP in US Atlantic EEZ is unknown, but stock abundance may have been affected by reduction in foreign fishing, curtailment of the Newfoundland drive fishery for pilot whales in 1971, and increased abundance of herring, mackerel, and squid stocks. There are insufficient data to determine the population trends for these species. The species are not listed under the Endangered Species Act. The total fishery-related mortality and serious injury for these stocks is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. These are a strategic stocks because the 1996-2000 estimated average annual fishery-related mortality, excluding Nova Scotia bycatches to pilot whales, Globicephala sp., exceeds PBR (Waring *et al.* 2002).

5.0 Description of Fisheries

5.1 Atlantic mackerel

5.1.1 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.

5.1.2 Stock Characteristics and Ecological Relationships

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) 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. 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.

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. 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. They also feed on small pelagic molluscs (*Spiratella* and *Clione*) when available. 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. 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). 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. 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).

5.1.3 Economic and Social Environment

5.1.3.1 Description of the Fisheries for Atlantic mackerel

5.1.3.1.1 Historical 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 roughly 8,500 mt in 1994 and 1995. US Atlantic mackerel landings increased to about 15,500 mt in 1996 and 1997 (valued at ranged from $4.6 million to $9.5 million). NMFS weighout data indicate that US Atlantic mackerel landings then declined to approximately 12,500 mt in 1998 and 1999 (valued at $4.7 million and $3.6 million, respectively). Atlantic mackerel landings declined further to 5,645 mt in 2000 (valued at $2.0 million) but increased to 12,308 mt in 2001 (valued at $2.2 million).

5.1.3.1.2 Description of 2002 Commercial Fishery

Based on NMFS dealer reports, Atlantic mackerel landings increased to 26,192 mt (valued at $6.1 million) in 2002. The 2002 landings of Atlantic mackerel by state are given in Table 1. The state of Rhode Island (36.4%) , New Jersey (35.5%) and Massachusetts (9.6%) accounted for the majority of landings in 2002. The mackerel season extends from January through April when greater than 95% of the annual landings are taken (Table 2). The principal gear used to land mackerel in 2002 were mid-water trawls (83%) and bottom otter trawls (15%)(Table 3). Joint venture landings accounted for 18% of total mackerel landings in 2002 (4,744 mt).

The landings of Atlantic mackerel by port in 2002 are given in Table 4. Cape May, NJ accounted for 34.6% of the of mackerel landings in 2002 , Portsmouth, RI (21.6%) by North Kingstown, RI (13.8%), and Gloucester, MA (9.0%). Two ports were dependent on Atlantic mackerel for more than 10% of the value of total fishery landings in 2002- Portsmouth, RI (96%) and North Kingstown, RI (26%) (Table 5).

5.1.3.1.3 Analysis of Human Environment/Permit Data

According to unpublished NMFS permit file data, there were 2407 vessels with Atlantic mackerel permits in 2002 (a roughly 10% increase compared to 2001) . These permits are currently open access and are available to any vessel which meets the size and horsepower restrictions implemented in Amendment 8 to the FMP. The distribution of vessels which possessed Atlantic mackerel permits in 2002 by home port state is given in Table 6. Most of these vessels were from the states of Massachusetts (41.6%), Maine (10.4%), New York (9.3%), New Jersey (6.9%), Rhode Island (5.9%), Virginia (4.4%), New Hampshire (3.7%) and North Carolina (4.1%).

In addition, there were 362 dealers which possessed Atlantic mackerel, squid and butterfish dealer permits in 2002. The distribution of these dealers by state is given in Table 7. Of the 362 dealers which possessed an Atlantic mackerel, squid and butterfish dealer permits in 2002, there were 108 dealers that reported buying Atlantic mackerel in 2002 (Table 8).

Based on NMFS dealer reports, a total of 408 vessels landed 26,192 mt of Atlantic mackerel valued at $6.1 million in 2002 (Table 9). Atlantic mackerel landing by permit category are given in Table 10. There were 196 vessels which landed 8,969 mt of Atlantic mackerel which possessed incidental catch permits.

5.1.3.1.4 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).

Recreational landings of Atlantic mackerel since 1981, as estimated from the NMFS Marine Recreational Fishery Statistics Survey, are given in Table 11. Total recreational mackerel landings have varied from 284 mt in 1992 to 4,223.4 mt in 1986. In recent years, recreational mackerel landings have varied from roughly 690 mt in 1998 to 1740 mt in 1997. However, recreational mackerel landings have exceeded 1,200 mt in most years since 1994. Annual recreational mackerel landings by state (Table 12) indicate that, in most years, the majority of recreational mackerel landings occur from Virginia to Maine, with highest catches occurring from New Jersey to Massachusetts. Most Atlantic mackerel are taken from boats (Table 13).

5.1.4 Description of areas fished

Atlantic mackerel landings in 2002 by NMFS three digit statistical area (Figure 1) are given in Table 14. Statistical areas 613, 537, 615, 539, and 612 accounted for about 95% the commercial Atlantic mackerel landings in 2002.

5.1.5 Current Market Overview for Mackerel

The Management Plan for Atlantic Mackerel, Squid, and Butterfish Fisheries requires that specific evaluations be made in the quota setting process before harvest rights are granted to foreign interests in the form of TALFF or joint venture allocations. The Council has concluded in recent years that conditions in the world market for mackerel have changed only slightly from year to year. The current market overview for Atlantic mackerel is updated below using data available to the Council at the time that this Environmental Assessment was prepared. These included data on world production of Atlantic mackerel by country through 2000. Data pertaining to import and export of Atlantic mackerel were available through 1998. US production, import and export data were available through 2002.

5.1.5.1 Recent World Production and Prices

According to the FAO, world landings of Atlantic mackerel were on an increasing trend in the early 1990's. In 1993, Atlantic mackerel world landings were estimated to be 840,833 mt. This represented a 7% increase from the 1992 landings (FAO 2000). Total world landings of Atlantic mackerel peaked in 1994 at 842,920 mt. World landings of Atlantic mackerel decreased steadily to about 560,000mt by 1997 and then increased slightly to 657,278 mt in 1998 (FAO 2000). World landings of Atlantic mackerel decreased to 617,784mt in 1999 and then increased slightly to about 674,000 mt in 2000. Overall, 2000 Atlantic mackerel production declined by 20% compared to the peak production observed in 1994 (FAO 2000).

Production of frozen mackerel (all species) increased from 1.2 million mt in 1994 to 1.35 million mt in 1996 (FAO 1996). However, total world production of frozen mackerel (all species) declined slightly to 1.2 million mt in 1996 (FAO 1997). Total world production of all mackerel species and products was steady at about 1.3 million mt in 1997 and 1998, down from 1.5 million mt in 1996 (FAO 2000).

Mackerel had been reported to be in short supplies in major international markets prior to 1997 (FN 1995, ITN 1996 and 1996a, FAO 1996, and SFI 1996). Limited supplies have generated intense pressure in the European Union (EU) mackerel market (ITN 1996a). This situation appeared unchanged through 1997. As a result, large quantities of mackerel were purchased by East European countries like Poland Russia, and Latvia. These purchases have increased pressure on prices, while leaving fewer supplies for more traditional markets such as Japan (SFI 1996). Quota reductions in western mackerel grounds are creating additional market uncertainty. Present market conditions might be expected to cause larger traders to increase "sourcing" and prices are likely to stay high or increase further.

Canada and Jamaica were the two most important markets for U.S. mackerel during the early to mid-1990's. Jamaica has been considered as one of the most steady and promising markets for US frozen mackerel. In 1995, the US exported 985 mt of frozen mackerel to Jamaica, this represented a 68% increase from 1994, and a 22% decrease from the 1991-1994 average. The frozen mackerel exported to Jamaica in 1995 was valued at $641/mt. US exports of frozen mackerel to Jamaica continued to increase steadily to 1,700 mt in 1999.

In 1995, Canada purchased 1,269 mt ($798/mt) of frozen mackerel from the US, this represented a 120% increase from 1994, and a 303% increase from the 1991-1994 average. The overall US export of fresh/chilled and frozen mackerel in 1995 was estimated at 3,296 mt, this represented a 12% increase from 1994, and a 22% decrease from the 1991-1994 average (Ross 1996). In 1996, the US exported 3,501 mt of Atlantic mackerel to Canada.

Total US exports of all mackerel species declined from 58,921 mt (valued at $56.7 million) in 1996 to only 11,748 mt (valued at $8.2 million) in 1999. Total US exports of all mackerel species was 17,367 mt in 1998. By 2001, US exports of all mackerel products totaled 26,456 mt valued at $16.7 million. According to NMFS export statistics, US exports of all mackerel products declined to 14,808 mt (valued at $12.9 million).

Canada was the largest importer of US fresh mackerel in 1999 (645 mt valued at $0.8 million)and 2000. Japan was the largest importer of US frozen mackerel in 1998 (5,804 mt valued at $3.5 million) followed by Australia (2,917 mt/$1.7 million), Jamaica (1,742 mt/ $1.65 million), Canada (1,579 mt/$1.3 million), Hong Kong (1,005 mt/$1.1 million), Philippines (901 mt/$1.1 million), and Uruguay (839 mt/$ 0.7 million). However, Japan imports of US frozen mackerel declined sharply to 751 mt in 1999. Nigeria was the largest importer of US frozen mackerel in 1998 (2,050 mt valued at $0.9 million) followed by Egypt (1,665 mt/$0.7 million), South Korea (1,641 mt/$1.3 million), Jamaica (1,614 mt/ $1.4 million), and Canada (809 mt/$0.7 million). US exporters placed an additional 102 mt of prepared/preserved mackerel products in foreign markets in 1998 valued at $0.15 million.

National Marine Fishery Service weighout data (Maine-Virginia), shows that the average exvessel prices for Atlantic mackerel in the US declined steadily from $400/mt ($0.18/lb) in 1989 to $281/mt ($0.13/lb) in 1994. Since then, exvessel prices have moved upward from $296/mt ($0.13/lb) in 1994 to $321/mt ($0.15/lb) in 1995. NMFS weighout data also show that US commercial landings of Atlantic mackerel increased from 4,653 mt in 1993 to 8,438 mt in 1995. Unpublished NMFS landings data indicate that US Atlantic mackerel landings increased to 15,406 mt in 1996, and subsequently declined to 12,509 mt and12,045 mt in 1998 and 1999, respectively. Ex-vessel prices for Atlantic mackerel declined slightly in 1996 to $296/mt ($0.13/lb) and then increased to $376/mt ($0.17/lb) in 1998. Ex-vessel prices for Atlantic mackerel declined again in 1999 to $299/mt ($0.13/lb) and then increased to $354/mt in 2000 ($0.16/lb). Ex-vessel prices for Atlantic mackerel increased again in 2000 to $354/mt ($0.16/lb) but declined to $178/mt ($0.08/lb) in 2001. Ex-vessel prices for Atlantic mackerel increased again in 2002 to $233/mt ($0.16/lb), even in the face of a 113% increase in US production of Atlantic mackerel in 2002. Industry members report that the increase in price in 2002 was due to an increase in the average size of mackerel landed in 2002.

5.1.5.2 Major Producers of Atlantic Mackerel

According to the FAO, world landings of Atlantic mackerel were on an increasing trend in the early 1990's. In 1993, Atlantic mackerel world landings were estimated to be 840,833 mt. This represented a 7% increase from the 1992 landings (FAO 2000). Total world landings of Atlantic mackerel peaked in 1994 at 842,920 mt. World landings of Atlantic mackerel decreased steadily to about 560,000mt by 1997 and then increased slightly to 657,540 mt in 1998 (FAO 2000). World landings of Atlantic mackerel increased steadily to about 674,000mt by 2000 (FAO 2002).

The leading producers of Atlantic mackerel in 1993 were the United Kingdom, Norway, Ireland, Russian Federation, USSR, the Netherlands, and Denmark. A similar pattern in landings by country was observed in 2000.

Country	1993 Landings (mt)	2000 Landings (mt)
United Kingdom	253,058	193,638
Norway	223,838	174,173
Ireland	94,979	70,183
Russian Federation	46,716	50,772
Netherlands	42,532	32,403
Denmark	42,056	31,642
Others	94,126	120,785
Total	841,445	673,596

5.1.5.3 Major Exporters of Mackerel

According to FAO statistics, total global mackerel exports (all species of mackerel combined) in 1993 were estimated at 945,206 mt and valued at $454 million. This represented an increase in exports and value of 12% and 3.6% from 1992, respectively (FAO 1993a). Total global mackerel exports (all species of mackerel combined) in 1996 declined to 819,214 mt (a 13% decline compared to 1993). However, the total value of exports increased to $753 million. Total global mackerel exports in 1997 declined again to 789,111 mt . However, the total value of exports increased to $763 million in 1997. Total global mackerel exports in 1998 increased to 853,376 mt (total value of exports decreased to $734 million in 1998). In 1993, major exporting countries of mackerel (fresh/frozen/chilled) include Norway, United Kingdom, Ireland, and the Netherlands (FAO 1993a). In 1998, Norway, United Kingdom and the Netherlands continued to be the leading exporters of mackerel products (FAO 2002).

Country	1993 Exports (mt)	2000 Exports (mt)
Norway	293,854	329,679
United Kingdom	216,517	81,097
Ireland	161,772	34,583
Netherlands	104,777	82,971
Korea	10,329	10,802
USA	4,273	15,054
Other	153,684	152,063
Total	945,206	706,249

5.1.5.4 Major Importers of Mackerel

According to FAO statistics, global mackerel imports (fresh/frozen/chilled) in 1993 were estimated at 770,165 mt, and valued at $446 million. This represented an increase in imports and value of 12% and 6.6% from 1992, respectively (FAO 1993a). Major importing countries of mackerel (fresh/frozen/chilled) in 2000 included Nigeria, Japan, Norway, Philippines, Norway, Egypt, Poland and the Russian Federation (FAO 2002):

Country	1993 Imports (mt)	2000 Imports (mt)
Japan	211,030	158,909
Nigeria	99,289	354,471
Norway	60,789	17,328
Netherlands	38,387	33,646
Poland	36,940	45,430
France	26,756	9,927
Côte d'Ivory	24,440	16,116
Russian Fed.	-	49,662
Egypt	15,819	52,242
Philippines	-	45,956
Thailand	15,038	22,737
Other	241,677	304,639
Total	770,165	1,111,063

5.1.5.5 The Current World Market for Mackerel

Strong warnings were issued in 1996 by European scientists about the potential collapse of the European Atlantic mackerel stock. Large cuts in the total allowable catch (TAC) were recommended in 1996 to restore the spawning stock biomass to safe levels. As the fishing quota for the North sea mackerel was reduced for the 1996 season, canners were actively trying to execute existing orders. Reports surfaced that "processors in Denmark and Scotland may be interested in frozen mackerel from other sources if the price is competitive" (ITN 1996).

The Norwegian government relaxed buying controls for pelagic catches from October 15, 1995 to January 1, 1996 (FN 1995). Those buying controls -- imposed by the Norwegian fisheries department -- force all pelagic catches landed in Norway to be sold at auctions through *Norges Sildesalgslag* (the Norwegian sales organization). This prevents Norwegians processors from buying mackerel from foreign vessels until all the Norwegian quota is taken. Buying controls were relaxed following the 20% cut in the Norwegian mackerel quota, it was expected that this move would have helped processors to secure raw material to supply important markets.

Japanese cold storage of frozen mackerel (horse mackerel and chub mackerel) was 82,406 mt as of April 30, 1996, up 20% from a year earlier (ITN 1996b). Although cold storage of frozen mackerel was up in Japan, buyers in that market were still showing strong demand for European mackerel.

A new mackerel cannery began operations in Papua New Guinea under the management of Malaysia's Kumpulan Fima group. This facility is expected to produce 36,000 mt of canned mackerel per year, 4,000 more mt than is needed to supply the domestic demand. The surplus production will be exported (ITN 1995a). The cannery is expected to operate on domestic and imported fish (FAO 1995).

5.1.5.6 Future Supplies of Mackerel

The potential for future mackerel production depends largely on the future production of the European mackerel stock. Prospects for the European mackerel stock in the mid-1990's were poor. Europe's western mackerel (ICES areas VI & VII) TAC for 1996 was cut by 55% (FNI 1996). In addition, further reductions to the TAC were agreed for the 1997 fishing year. The 1996 reductions were far above the European scientific recommendations. According to European scientific recommendations, large cuts in mackerel TACs were needed in 1996 to restore the spawning stock biomass to a minimum biological threshold of 2.3 million mt by 1997-1998. That meant that fishing mortality in 1996 would need to be reduced by 80% compared to 1994 in one year. In other words, to achieve this biological goal, the overall western mackerel TAC in 1996 should have been reduced to 144 thousand mt compared with 762 thousand mt in 1994 (FNI 1995 and FN 1995a). In fact, the TAC's agreed upon for the European mackerel stocks decreased from 837,000 mt in 1994 to 645,000 mt in 1995 and finally to 452,000 mt in 1996. Actual landings exceeded the TAC specifications in 1994 and 1995 when European landings of Atlantic mackerel were 823,000 and 756,000 mt, respectively.

The most recent ICES stock assessment report available for the European mackerel stock indicates that three of the four component stocks appear to have improved markedly since the precautionary approach to setting TAC's was adopted for the European mackerel stock in 1996. In 1998, ICES recommended that fishing mortality (F) be reduced by at least 50% which corresponded to a TAC of 452, 000 mt (actual landings that year were 667,000 mt). Since then, the ICES scientific recommendation has been to maintain F at 0.17with a corresponding TAC's ranging from 542,000 to 694,000 mt. European mackerel stock production appears to have stabilized at levels of about 600,000 mt. These levels are approximately 150,000-200,000 mt lower than those observed in mid-1990's. This reduction in European mackerel production is also about equal to the long term sustainable yield of the Northwest Atlantic mackerel stock. Thus, it appears that the recent increase in demand for US mackerel will likely continue to remain high even if US production begins to increase to levels approaching MSY.

5.1.5.7 US Production and Exports of Mackerel

NMFS weighout data showed that in 1995, Atlantic mackerel landings increased by 81% from the 1993 level. The average value of mackerel increased over 14% for the same period.

In 1991, landings peaked due to a relatively successful internal water processing venture between Russia and the state of New Jersey, and the one-year open door into the Japanese market. That year US producers were able to ship over more than 2,800 mt of frozen mackerel to Japan at an average value of $882/mt. The following year shipments fell to only 63 mt.

Overall, US exports of fresh/chilled and frozen mackerel in 1995 were estimated at 3,296 mt, this represented a 12% increase from 1994, and a 51% increase from 1993 (Ross 1996). In 1995, US producers were able to export 2,303 mt of frozen Atlantic mackerel valued at $1.7 million ($747/mt), and 992 mt of fresh/chilled mackerel valued at $1.5 million ($1,207/mt). US exports of Atlantic mackerel continued to increase in 1996 to 6,137 mt valued at $5.3 million. US exports of all mackerel species were 17,367 mt valued at $14.2 million in 1998. US exports of all mackerel species declined to 11,747 mt in 1998.

The lack of mackerel in the North Sea area and the potential for future mackerel TAC reductions are providing opportunities for US producers to place additional exports of mackerel in the international market. Mackerel prices in the international market have increased in recent years which should help the US Atlantic mackerel industry in their attempt to sell large volumes of this product (Ross 1996). In 1995, the US exported small quantities of Atlantic mackerel to non-traditional markets such as South Korea, Mexico, and Brazil. In 1996, US exporters placed Atlantic mackerel in Latvia, the Philippines, and South Africa.

By 2001, US exports of all mackerel products totaled 26,456 mt valued at $16.7 million. According to NMFS export statistics, US exports of all mackerel products declined to 14,808 mt (valued at $12.9 million). The US exported 1,539 mt of fresh mackerel in 2002, 81% of which went to Canada. Additional export markets in 2002 for fresh mackerel included Bulgaria, Spain, and Malaysia. The US exported 12,242 mt of frozen mackerel in 2002, with Nigeria and Japan being the leading markets.

5.1.5.8 Trade Barriers

Japan- started to phase in tariff reductions on 219 fisheries items entering the country. These reductions have been approved through GATT negotiations. Mackerel is one of the major fishery products subject to tariff reduction (ITN 1995b). The tariff of frozen mackerel will be reduced from a 10% base rate to a new rate of 7%. This rate was to be reduced over a 5 year period beginning in 1995. The stated base rate has already had the first tariff reduction taken out. The mackerel base rate in 1995 was 10% with 0.6% reduced each year for 5 years until the rate gets to 7%. This tariff rate reduction is not "bound", therefore, rates may increase at some future date depending on market conditions in Japan (Ross 1995). The tariff for horse mackerel remain unchanged (ITN 1995b).

The Republic of Korea's- National Fisheries Administration has announced the liberalization of fish imports for 1995-1997. Liberalization of the following mackerel products are expected (ITN 1994):

Date	Item
July 1, 1996	Mackerel (excluding livers)
July 1, 1996	Mackerel (prepared/canned goods)
July 1, 1997	Mackerel (excluding livers and roes/fresh or chilled)

Korea has agreed to establish an import tariff rate of 10% on most fresh/frozen/dried seafood and 20% on prepared preserved food (Ross 1995).

The European Community- has a seasonal tariff on mackerel. During the EC peak season of June 16 - February 14, an unchanged 20% tariff is levied on foreign imports of mackerel (fresh/chilled fish excluding fillets). For fresh/chilled/frozen mackerel fillets and other mackerel meat there is a 15% year-round tariff (ITN 1994a and 1994b).

Taiwan- has requested membership in the World Trade Organization/GATT. US negotiators have been working to reduce existing Taiwanese barriers to various seafood products. In addition to significant reductions in key Taiwanese import tariffs, several Non-Tariff Measure (N.M.) which affect regional exporters are also to be reduced. At the present time, imports of squid, mackerel, sardines, herring, and catfish are not allowed into the country. The Taiwanese government has proposed to liberalize the NTM's over a 6-year phase-in period, except squid which will be liberalized in 1997 (Ross 1995).

Peoples Republic of China- is expected to drop import tariff rates once it becomes a member of GATT. The import tariff rate for frozen mackerel is expected to go from the base rate of 30% to the proposed rate of 15% (Ross 1995).

US- Has made concessions on 46 tariff lines. Canned mackerel is one of the major fishery products subject to tariff reduction, which has been reduced from 6 to 3% (ITN 1995c).

5.1.5.9 Processor Survey Results for Mackerel

Each year the Mid-Atlantic Council surveys East Coast processors to ascertain their expectations on current and future mackerel production. Totals are not directly comparable between years because the respondents (and their numbers) will differ from year to year.

The last year that processor production estimates for Atlantic mackerel are available was for 2000-2002 and were as follows (mt):

Product/Market	2001 (15 Reporting)	2002 (12Reporting)
US Food Market	4,888	8,790
US Bait Market	3,390	3,740
Foreign Export Market	15,941	26,789
TOTAL	24,219	38,789

Given the number of number of reporting units in 2002, these production estimates will likely increase due to the lower number of respondents. A number of the larger known processors failed to return the survey.

5.2 *Loligo pealei*

5.2.1 Status of the stock

Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan (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}.

A 1999 assessment of the *Loligo* stock (SAW 29) concluded that the stock was approaching an overfished condition and that overfishing was occurring at that time (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 in 1998 was 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. 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 F_{msy}. Based on the SAW 29 projections, the Council chose to specify ABC as the yield associated with 90% F_{msy} or 13,000 mt in 2000.

More recent survey data for *Loligo* squid indicate that abundance of this species has increased significantly since analyses presented in SAW 29. Estimates of biomass based on NEFSC fall 1999 and spring 2000 survey indices for *Loligo* indicate that the stock has been at or near B_{msy} since 1998 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 and 2002 quotas 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 most recent survey data indicate that *Loligo* remain at a high level of abundance. The 2002 fall survey index for *Loligo* was the second highest index value since 1967 and exceeded the 90th percentile for the time series.

The *Loligo* stock was most recently assessed by the 34th Northeast Regional Stock Assessment Committee (SARC 34). New analyses of survey data indicated that Loligo stock biomass since 1967 has fluctuated without trend and has supported annual catches around 20,000 mt. A new surplus production model suggests that biomass has fluctuated between 14,000 and 27,000 mt since 1987. During this period quarterly F fluctuated between 0.06 and 0.6 about a mean of 0.24. While estimates of biomass have increased in recent years based on survey data, biomass in the longer has fluctuated without trend.

SARC 34 concluded that it is unlikely that overfishing is occurring. The largest feasible scaled catch-survey estimates of fishing mortality for 2000-2001 ranged from 0.11-0.17 per quarter. Estimates of fishing mortality from a surplus production model ranged from 0.12-0.31 per quarter. Thus all recent estimates of fishing mortality are well below the biomass weighted estimates of F_{max} for *Loligo*. Results from length based virtual population analyses (LVPA) and catch survey biomass estimates for winter and spring surveys generally indicated that fishing mortality rates for *Loligo* declined to relatively low levels during 2000 and 2001.

SARC 34 also concluded that it is unlikely that the Loligo stock is overfished. Survey data (with the exception of the Massachusetts inshore spring survey), LVPA results, scaled survey biomass estimates, and production modeling estimates all indicate that *Loligo* biomass was high in 2000 and 2001. The smallest feasible catch-survey biomass estimate for 2001 was 34,000 mt, which is smaller than the best available estimate of $B_{msy}/2$ (40,000 mt). However, the probability that the *Loligo* biomass is less than or equal to the lowest feasible biomass is small. SARC 34 recommended that the Council maintain the current catch of 20,000 mt (to include both landings and discards).

Based on the assumption that the stock will be at or near B_{msy} in 2002, the Council recommended that the 2003 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). Given the management advice in SARC 34 and that the FMP currently specifies that the annual target quota be specified as the yield associated with 75% F_{msy}, Council staff recommended that the status quo be maintained for *Loligo* in 2003.

As noted above, the 2000 quota was allocated among three four month trimesters in an attempt to ensure that landings and fishing mortality were distributed throughout the fishing year. During Quota Period I in 2000, the directed fishery was closed on March 25, 2000. During Quota Period II, the directed fishery was closed on July 2, 2000. In addition, the quota for each period was exceeded, causing the dislocation of quota from the Quota Period III. As a result of these premature closures and overages, the Council recommended that the 2001 quota of 17,000 mt be allocated as follows. The annual quota will be allocated to quarterly quota periods based on the quarterly seasonal distribution of landings during the period 1994-1998. Based on this criteria, the 2001 quota allocations among quarters was allocated as follows: Quarter 1: 5,649.1 mt (33.23%), Quarter 2: 2,993.7 mt, (17.61%),Quarter 3: 2,941 mt (17.3 %),Quarter 4: 5,416.2 mt (31.86 %). In addition, the Council recommended for Quarters 1 through 3, that the directed fishery be closed when 80% of the quarter's allocation is taken and that vessels be restricted a 2,500 pound trip limit for the remainder of the quarter. In addition, the Council recommended that quarterly overages be deducted as follows: an overage in quarter 1 will be deducted from quarter 3 and an overage in quarter 2 will be deducted from quarter 4. In addition, in 2003, the Council added a provision that if the first quarter landings were less than 80% of the first quarter allocation, the underage below 80% of the quarter will be applied to quarter 3. Underages from quarters 2 and 3 were to be added to quarter 4 by default based on the 95% closure rule for the annual quota. When 95% of the total annual quota has been taken (i.e, 16,150 mt) the trip limit will be reduced to 2,500 pounds and will in remain in effect for the rest of the fishing year. One aspect of the quota system which was examined in 2003 was the 80% threshold for closure of the directed fishery in quarters 1-3. The results of that analysis indicated that the 80% threshold appeared to be appropriate.

As noted above, based on the assumption that the stock will be at or near B_{msy} in 2002, the Council recommended that the 2003 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). Given the management advice in SARC 34 and that the FMP currently specifies that the annual target quota be specified as the yield associated with 75% Fmsy, Council staff recommend that the status quo be maintained for *Loligo* in 2004. In addition, Framework 2 to the FMP added a provision to allow for the specification of management measures for multiple years for *Loligo*. Therefore, the Council recommended that these specifications be maintained for 2004-2006, unless they are changed in the future during the annual quota setting procedure or by an in-season adjustment.

5.2.2 Stock Characteristics and Ecological Relationships

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).

Loligo 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).

5.2.3 Economic and Social Environment

5.2.3.1 Description of the Historical Fisheries for *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 had 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. With 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 by 1992.

US *Loligo* landings were about 22,500 mt in 1993 and 1994 (valued at $29.1 and $31.9 million, respectively). *Loligo* landings declined to 17,928 mt in 1995 (value declined to $23.0 million) and then increased slightly to 18,008 mt in 1995 (dockside value remained stable at $23.1 million). *Loligo* landings declined to 12,459 mt in 1996 (valued at $18.6 million) and then increased to 16,203 mt in 1997 (valued at $26.5 million). Loligo landings were about 18,500 mt in 1998 and 1999 and then declined to 16,561 mt in 2000. Based on NMFS dealer reports, a total 14,091 mt (31.1 million pounds) of *Loligo* (valued at $20.5 million) was landed in 2001.

5.2.3.2 Description of the 2002 *Loligo* Fishery

Based on NMFS dealer reports, a total 16,280 mt of *Loligo* (valued at $22.9 million) was landed in 2002. The 2002 landings of *Loligo* by state are given in Table 15. Four states, Rhode Island, New York, New Jersey and Massachusetts accounted for the majority (97%) of *Loligo* landings in 2002. Rhode Island accounted for half of the 2002 *Loligo* landings. The 2002 landings of *Loligo* by month are given in Table 16. The majority of *Loligo* landings occurred in the late winter/spring and fall months. Most (99%) were taken by otter trawls (Table 17).

According to unpublished NMFS permit file data, there were 381 vessels with *Loligo*/butterfish moratorium permits in 2002. These are limited access permits and are available only to vessels which meet the qualifications specified in Amendment 5 to the FMP in 1997. The distribution of vessels which possessed *Loligo*/butterfish moratorium permits in 2002 by home port state is given in Table 18. Most of these vessels were from the states of Massachusetts (29.9%), New York (19.2%), Rhode Island (15.5%), New Jersey (11.3%), North Carolina (7.6%), Virginia (4.5%), and Connecticut (1.6%). In addition, there were 362 dealers which possessed Atlantic mackerel, squid and butterfish dealer permits in 2002. The distribution of these dealers is given by state in Table 7. Of the 362 dealers which possessed a Atlantic mackerel, squid and butterfish dealer permit in 2002, there were 133 dealers that reported buying *Loligo* in 2002 (Table 19).

The landings of *Loligo* by port in 2002 are given in Table 20. Point Judith, RI accounted for about 30% over one-third of the *Loligo* landings in 2002. Other important ports in terms of *Loligo* landings included Hampton Bay, NY (14.6%), Montauk, NY (10.2%) Cape May, NJ (7.8%), Newport, RI (7.6%)and North Kingstown, RI (7.4%). There were 11 ports that were dependent on *Loligo* for more than 10% of the value of total fishery landings in those ports in 2002 (Table 21).

5.2.3.3 Analysis of Human Environment/Permit Data

Based on NMFS dealer reports, a total of 426 vessels landed 16,280 mt (35.9 million pounds) of *Loligo* valued at $22.9 million in 2002 (Table 9). Most of *Loligo* landed in 2002 was taken by *Loligo*/butterfish moratorium permit holders (Table 10). About 68% of the vessels which possessed *Loligo*/butterfish moratorium permits in 2002 actually landed *Loligo.* There were 190 vessels which landed 3,452 mt of *Loligo* in 20002 which possessed incidental catch permits (Table 10).

5.2.4 Description of areas fished

The 2002 landings of *Loligo* by NMFS statistical area (three digit) are given in Table 22. There were three statistical areas which, individually, accounted for greater than 10% of the *Loligo* landings in 2002: 613, 537, and 616. Collectively, these three areas accounted for about half of the 2002 *Loligo* landings. The top seven statistical areas accounted for greater than 75% of the 2002 *Loligo* landings.

5.3 *Illex illecebrosus*

5.3.1 Status of the Stock

The most recent assessment of the *Illex* stock (SAW 37) concluded that while it is not possible to evaluate current stock status for *Illex* (since current stock size can't be reliably estimated and therefore is unknown), overfishing is not likely to have occurred during 1992-2002. Relative exploitation indices have declined since reaching a peak in 1999 and were below the 1982-2002 mean during the most recent three year period (1999-2002). Recent declines in mean body weights , as well as recently declining biomass indices from US and Canadian surveys, suggest that the stock is currently in a low productivity regime.

5.3.2 Stock Characteristics and Ecological Relationships

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 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).

Short-finned squid feed primarily on fish, cephalopods (i.e. squid) and crustaceans. Fish prey include the early life history stages of Atlantic cod, Arctic cod and redfish (Squires 1957, Dawe *et al.* 1997), sand lance (Dawe *et al.* 1997), mackerel and Atlantic herring (O'Dor *et al.* 1980, Wigley 1982, Dawe *et al.* 1997), haddock and sculpin (Squires 1957). *Illex* also feed on adult capelin (Squires 1957, O'Dor *et al.* 1980, Dawe *et al.* 1997), smelt and mummichogs (O'Dor *et al.* 1980). Cannibalism is significant, and *Illex* also feed on long-finned squid, *Loligo pealei* (Vinogradov 1984). Maurer and Bowman (1985) have demonstrated a seasonal shift in diet.

When *Illex* are offshore in the spring, they primarily consume euphausiids, whereas they consume mostly fish and squid when they are inshore in the summer and fall. Individuals 2.4-4 in (6-10 cm) and 10.4-12 in (26-30 cm) ate mostly squid, 4.4-6 in (11-15 cm) *Illex* ate mostly crustaceans and fish, and those 6.4-8 in (16-20 cm) ate mostly crustaceans. Perez (1994) also demonstrated an ontogenetic shift in diet, as short-finned squid consume less crustaceans and more fish as they grow larger.

The most important prey items of *Illex* from the NEFSC bottom trawl survey data on food habits were crustaceans, fish and cephalopods. During 1973-1980, the diet of 0.4-4 in (1-10 cm) long squid was made up of crustaceans (13%), nematodes (10%) and fish (4.5%), and the diet of 4.4-16 in (11-40 cm) long squid was composed of crustaceans (17%), cestodes (11%), fish (11%) and cephalopods (8%). During 1981-90, the diet of squid 4.4-16 in (11-40 cm) in length, was dominated by cephalopods (30%) and fish (23%).

Numerous species of pelagic and benthic fishes are known to prey extensively on *Illex*, including bluefin tuna (Butler 1971), silver hake and red hake (Vinogradov 1972). Other fish predators include bluefish (Maurer 1975, Buckel 1997), goosefish (Maurer 1975, Langton and Bowman 1977), four-spot flounder (Langton and Bowman 1977), Atlantic cod (Lilly and Osborne 1984), sea raven (Maurer 1975), spiny dogfish (Templeman 1944, Maurer 1975), and swordfish (Langton and Bowman 1977, Stillwell and Kohler 1985, Scott and Scott 1988). Mammalian predators include pilot whales (Squires 1957, Wigley 1982) and the common dolphin (Major 1986). Seabird predators include shearwaters, gannets and fulmars (Brown *et al.* 1981). Short-finned squid are known to exhibit a variety of defense mechanisms in order to reduce predation, such as camouflage coloration, (O'Dor 1983), schooling behavior, direction changes and ink release (Major 1986).

5.3.3 Economic and Social Environment

5.3.3.1 Description of the Historical Fisheries for *Illex*

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.

Illex landings reached 18,012 mt in 1993 and then rose slightly to a then 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). In 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. *Illex* landings were 22,705 mt in 1998 valued at $9.2 million. *Illex* landings averaged 17,142 mt for the period 1994-1998. Unpublished NMFS weighout data indicate that 7,361 mt of *Illex* valued at $3.9 million was landed in 1999and that 9,041 mt of *Illex* valued at $3.7 million was landed in 2000. Unpublished NMFS weighout data indicate that 3,939 mt of *Illex* valued at $1.8 million was landed in 2001.

5.3.3.2 Description of 2002 *Illex* Fishery

Unpublished NMFS weighout data indicate that 2,723 mt of *Illex* valued at $1.4 million was landed in 2002. The 2002 landings of *Illex* by state are given in Table 23. Two states, Rhode Island and New Jersey accounted for the majority (>95%) of Illex landings in 2002. Rhode Island accounted for more than 87% of the 2002 Illex landings. The 2002 landings of *Illex* by month are given in Table 24. The majority of Illex landings occurred in the summer and early fall. Virtually all (99.9%) were taken by bottom otter trawls (Table 25).

The landings of *Illex* by port in 2002 are given in Table 26. North Kingstown, RI accounted for greater than 70 % of the *Illex* landings in 2002. Other important ports in terms of *Illex* landings included Point Judith, RI (16.6%), Cape May, NJ (4.8%), and Elizabeth, NJ (3.4%). North Kingstown, RI was the only port that was dependent on *Illex* for more than 10% of the value of total fishery landings in 2002 (Table 27).

According to unpublished NMFS permit file data, there were 72 vessels with Illex moratorium permits in 2002. These are limited access permits and are available only to vessels which meet the qualifications specified in Amendment 5 to the FMP. The distribution of vessels which possessed Illex moratorium permits in 2002 by home port state is given in Table 28. Most of these vessels were from the states of New Jersey (20.8%) Massachusetts (20.8%), Rhode Island (15.3%) New York (11.1%), and North Carolina (12.5%). In addition, there were 362 dealers which possessed Atlantic mackerel, squid and butterfish dealer permits in 2002. The distribution of these dealers is given by state in Table 7. Of the 362 dealers which possessed an Atlantic mackerel, squid and butterfish dealer permit in 2001, there were 19 dealers that reported buying Illex in 2002 (Table 29).

5.3.3.3 Analysis of Human Environment/Permit Data

Based on NMFS dealer reports, a total of 36 vessels landed 2,723 mt of *Illex* valued at $1.4 million in 2001 (Table 9). Virtually all of the *Illex* landed in 2002 was taken by *Illex* moratorium permit holders (Table 10). However, only 15% of the vessels which possessed *Illex* moratorium permits in 2001 actually landed *Illex*. Thus, most of the *Illex* fleet was inactive in the 2002 *Illex* fishery. Most of the vessels which landed *Illex* during 2002 also possessed *Loligo*/butterfish moratorium and Atlantic mackerel permits (Table 10). There were 11 vessels which landed 0.3 mt of *Illex* which possessed incidental catch permits.

5.3.4 Description of the areas fished

The 2002 landings of *Illex* by statistical area (Figure 1) are given in Table 30 (includes only the three digit statistical areas that individually accounted for greater than 1% of the *Illex* landings in 2002). Three statistical areas (632,626 and 622) accounted for the vast majority (91%) of *Illex* landings in 2001. Two-digit statistical area 62 accounted for 45% of total *Illex* landings in 2002.

5.4 Atlantic butterfish

5.4.1 Status of the stock

The SAW 17 (NMFS 1994a) Advisory Report included the following concerning the state of the stock:

"The Atlantic butterfish stock is at a low to medium biomass level and current catch levels are below the MSY of 16,000, however, exploitation rate is unknown. Although recruitment of butterfish has remained high in recent years, the stock size of adults has declined since 1990 and is currently well below average. Since 1988, annual butterfish landings have averaged 2,500 mt, or only 25% of the domestic allowable harvest (DAH) of 10,000 mt. Landings in 1993 are projected to be 3,000 mt. Survey biomass indices in autumn 1992 and spring 1993 were among the lowest in the survey time series. Fishing effort increased in 1992 but, overall, has been relatively stable since 1984. Commercial landings per unit of effort (LPUE) in 1992 remained at the low levels observed since 1988."

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."

5.4.2 Stock Characteristics and Ecological Relationships

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 °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).

Butterfish feed mainly on planktonic prey, including thaliaceans (primarily Larvacea and Hemimyaria), molluscs (primarily squids), crustaceans (copepods, amphipods, and decapods), colenterates (primarily hydrozoans), polychaetes (primarily Tomopteridae and Goniadidae), small fishes, and ctenophores (Fritz 1965, Leim and Scott 1966, Haedrich 1967, Horn 1970a, Schreiber 1973, Mauer and Bowman 1975, Tibbets 1977, Bowman and Michaels 1984).

The food habits of butterfish collected on the Northeast Shelf during NEFSC bottom trawl surveys from 1973 to 1990 were similar to diets reported in the literature. The stomach contents were dominated by unidentified animal remains. Arthropods dominated the identifiable items, followed by urochordates (thaliaceans and larvaceans), plankton, annelids (probably polychaetes), chaetognaths (arrowworms), molluscs (probably squids), cnidarians (coelenterates, probably jellyfish), and fishes.

Butterfish are preyed on by many species including haddock, silver hake, goosefish, weakfish, bluefish, swordfish, sharks (hammerhead), and *Loligo* (Bigelow and Schroeder 1953, Scott and Tibbo 1968, Horn 1970a, Maurer and Bowman 1975, Tibbets 1977, Stillwell and Kohler 1985, Brodziak 1995a).

5.4.3 Economic and Social Environment

5.4.3.1 Description of the Historical Fisheries for 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). Butterfish landings decreased to 1,432 mt in 2000 (valued at $1.5 million). Unpublished NMFS weighout data indicate that 4,380 mt of butterfish valued at $3.2 million was landed in 2001.

5.4.3.2 Description of 2002 Butterfish Fishery

Unpublished NMFS weighout data indicate that 841 mt of butterfish valued at $0.9 million was landed in 2002. The 2002 landings of butterfish by state are given in Table 31. Two states, Rhode Island and New Jersey accounted for the majority (>77%) of butterfish landings in 2002. Rhode Island accounted for 49.2% of the 2002 butterfish landings. The 2002 landings of butterfish by month are given in Table 32. Most (99%) were taken with bottom otter trawls (Table 33).

The landings of butterfish by port in 2002 are given in Table 34. Two Rhode Island ports, Port Judith and Montauk, NY accounted for more than half of the butterfish landings in 2002. Other important ports in terms of butterfish landings included Hampton Bay, NY (7.4%), and New Port, RI (5.9%). There were no ports that were dependent on butterfish for more than 10% of the value of total fishery landings in 2002 (Table 35).

5.4.3.3 Analysis of Human Environment/Permit Data

According to unpublished NMFS permit file data, there were 381 vessels with Loligo/butterfish moratorium permits in 2002. These are limited access permits and are available only to vessels which meet the qualifications specified in Amendment 5 to the FMP in 1997. The distribution of vessels which possessed Loligo/butterfish moratorium permits in 2002 by home port state is given in Table 18. Most of these vessels were from the states of Massachusetts (29.9%), New York (19.2%), Rhode Island (15.5%), New Jersey (11.3%), North Carolina (7.6%), Virginia (4.5%), and Connecticut (1.6%). In addition, there were 362 dealers which possessed Atlantic mackerel, squid and butterfish dealer permits in 2002. The distribution of these dealers is given by state in Table 7. Of the 362 dealers which possessed an Atlantic mackerel, squid and butterfish dealer permits in 2002, there were 112 dealers that reported buying butterfish in 2002 (Table 36).

Based on NMFS dealer reports, a total of 453 vessels landed 841 mt of butterfish valued at $0.9 million in 2002 (Table 9). Most of the butterfish landed in 2002 was taken by *Loligo*/butterfish moratorium permit holders (Table 10). There were 200 vessels which landed 198 mt of butterfish which possessed incidental catch permits. The distribution of incidental catch permit holders by state in 2002 is given in Table 37.

5.4.4 Description of the areas fished

The 2002 landings of butterfish by NMFS three-digit statistical area (Figure 1) are given in Table 38. Statistical area 537 was the most important area, accounting for 20.3% of total butterfish landings in 2002. Other important statistical areas for butterfish included areas 525, 526, 613, 616, and 539.

6.0 Environmental Consequences and Initial Regulatory Flexibility Analysis of the Alternatives

6.1 Impacts of Alternative 1 on the Environment

6.1.1 Biological Impacts

6.1.1.1 Alternative 1 for Atlantic mackerel (No Action - 2003 status quo and least restrictive alternative))

The specifications under this alternative would be ABC = 347,000 mt, IOY=175,000 mt, DAH=175,000 mt, DAP=150,000 mt and JVP=10,000 and TALFF=0 mt. They represent the 2003 status quo and least restrictive alternative for Atlantic mackerel.

For Atlantic mackerel, maximum sustained yield (MSY) and the biomass that produces MSY in the long-term (B_{MSY}) were most recently estimated by Applegate *et al.* (1998). F_{MSY} was estimated to be 0.45 and B_{MSY} was estimated to be 890,000 mt. These values form the basis of the definition of overfishing for Atlantic mackerel. The maximum fishing mortality rate is defined as F_{MSY}=0.45 and the minimum stock biomass is defined as 1/4 B_{MSY} or 225,000 mt. The target fishing mortality rate is defined as the tenth bootstrap percentile of F_{MSY} when SSB is greater than 890,000 and decreases linearly to zero as SSB approached ½ B_{MSY}.

A control rule was developed in Amendment 8 from the age-based MSY-based reference points and uncertainty in the estimate of F_{MSY} (Applegate *et al.* 1998). When SSB is greater than 890,000 mt, the overfishing limit is F_{MSY} (0.45), and the target F is the tenth bootstrap percentile of F_{MSY} (0.25). To avoid low levels of recruitment, the limit 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}). The most current estimates of SSB and F (1994) indicate that SSB is well above B_{MSY} and F is well below F_{MSY} (NMFS 1996b). The target mortality rates account for uncertainty in the estimate of F_{MSY}.

As noted above, the most recent estimate of Atlantic mackerel stock biomass was estimated to be 2.1 million mt, well above the target biomass of 890,000 mt. Therefore, the yield associated with the target fishing mortality rate of F=0.25 adopted in Amendment 8 is 369,000 mt, which is the appropriate basis for ABC. Therefore, ABC specification of this alternative is consistent with the overfishing control rule adopted in Amendment 8 (F=0.25 yield estimate of 369,000 mt - the estimated Canadian catch of 22,000 mt).

The Council recommended that the specification for DAP for 2003 be set at 150,000 mt. In addition, the Council also recommended that the JVP specification be specified at 10,000 mt and TALFF be specified at 0 mt in 2003. If the recreational allocation of 15,000 mt is summed with

DAP and JVP, then DAH equaled 175,000 mt. If DAH and TALFF are summed then IOY equaled 175,000 mt.

As noted above, the specification of IOY for 2003 was 175,000 mt. This level of exploitation is not expected to have a negative biological effect on the Atlantic mackerel stock. The overfishing definition adopted for Atlantic mackerel in Amendment 8 is designed to protect the stock from overfishing and was developed to comply with the Sustainable Fisheries Act. Based on the current condition of the stock, an IOY specification of 175,000 mt is considerably less than the yield associated with either the target or threshold fishing mortality rate specified for this stock based on the Amendment 8 overfishing definition. In other words, population modeling of the Atlantic mackerel stock dynamics indicate that the safe level of removals from the current mackerel stock size is considerably higher than the level proposed under this alternative. As a result, the Council concluded that the level of exploitation associated with an IOY of 175,000 mt is not expected to have any significant biological effects on the Atlantic mackerel stock. In addition, this IOY specification is not expected to significantly impact non-target species that prey on Atlantic mackerel since assumptions about natural mortality are made implicitly in the calculation of MSY. That is, the allowable fishery yields at the biological reference points defined in the FMP are *in addition to* assumed mortality due to natural causes, including mortality due to predation.

6.1.1.2 Alternative 1 for *Loligo* (2003 status quo and 2004-2006 preferred alternative)

The specifications under this alternative would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 17,000 mt and JVP and TALFF = 0 mt. In terms of the annual quota, these specifications represent the 2003 status quo (No Action - status quo). They were also adopted as the preferred alternative by the Council for 2004. The Council also recommended that these specifications remain in effect for 2004-2006, unless changed during future quota setting.

MSY, B_{MSY} and F_{MSY} form the basis for definitions of overfishing relative to biological reference points outlined in the Magnuson-Stevens Act. The overfishing definition for *Loligo* was revised in Amendment 8 to comply with the SFA as follows: overfishing for *Loligo* is 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}). Annual quotas are to 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_{msy}. In addition, the biomass target is specified to equal B_{MSY}.

The recommended specifications under this alternative are consistent with the overfishing definition adopted in Amendment 8. The yield associated with 75% of F_{msy} at B_{msy} is 17,000 mt for *Loligo* based on projections in SAW-29 (NMFS 1999). Given the management advice in SARC 34 and that the FMP currently specifies that the annual target quota be specified as the yield associated with 75% F_{msy}, the Monitoring Committee recommended that the status quo be maintained for *Loligo* in 2004. Since this specification is consistent with the FMP overfishing definition and the most recent stock assessment advice , the Council concluded that the level of exploitation associated with an ABC, IOY, DAH, and DAP specification of 17,000 mt is not expected to have any negative biological effects on the *Loligo* stock, nor will it impact non-targeted species.

In 2003 the Council changed to the allocation of the 2003 quota relating to underages in quarter 1. In the 2003 specifications, if the first quarter landings were less than 70% of the first quarter allocation, the underage below 70% of the quarter were to be applied to quarter 3. The Council recommended that this be increased to 80% in 2003. In setting the 2004 specifications, the Council recommended that this change be maintained in 2004. This change in the quarter 1 underage provision is not expected to cause overages since the overall quota controls fishing mortality. This change is not expected to result any negative biological effects on the *Loligo* stock, nor will it impact non-targeted species since the fishery is ultimately governed by the overall quota.

6.1.1.3 Alternative 1 for *Illex* (2003 status quo with minor change and 2004 preferred alternative with minor change)

The specifications under this alternative would be Max OY, ABC, IOY, DAH, and DAP = 24,000 mt and JVP and TALFF = 0 mt. These recommended specifications remain unchanged from the 2003 specifications and thus represent the status quo. They were also adopted as the preferred alternative by the Council for 2004. In addition to specifying the quota at 24,000 mt in 2004, the Council also recommended that the non-moratorium bycatch allowance be increased to 10,000 pounds per trip.

The overfishing definition for *Illex* was revised in Amendment 8 to comply with the SFA as follows: overfishing for *Illex* is defined 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 defined as 75% of the $F_{msy.}$

The most recent assessment of the *Illex* stock (SAW 37) concluded that while it is not possible to evaluate current stock status for *Illex* (since current stock size can't be reliably estimated and therefore is unknown), overfishing is not likely to have occurred during 1992-2002. Relative exploitation indices have declined since reaching a peak in 1999 and were below the 1982-2002 mean during the most recent three year period (1999-2002). Recent declines in mean body weights , as well as recently declining biomass indices from US and Canadian surveys, suggest that the stock is currently in a low productivity regime.

Since data limitations did not allow an update of yield estimates at the threshold and target fishing mortality rates, the Council recommended that the specification of MAX OY and ABC be specified at 24,000 mt (yield associated with F_{msy}) in 2004 (same as in 2003). Under this option, the directed fishery for *Illex* would remain open until 95% of ABC is taken or 22,800 mt. This level of landings is also equal to the most recent estimate of the yield associated with 75% F_{msy} for *Illex*. When 95% of ABC is taken, the directed fishery will be closed and a 10,000 pound trip limit will remain in effect for the remainder of the fishing year. Due to the large volume/low value nature of the *Illex* fishery, closure of the directed fishery essentially results in a complete closure of the fishery, since a very low level of landings is expected after a directed *Illex* fishery closure. Thus, the Council concluded that these specifications are consistent with the FMP overfishing definition for *Illex* and, therefore, are not expected to have any negative biological effects on the *Illex* stock.

In setting the quota for 2004, the Council considered the management advice provided by SAW 37 that the nominal TAC of 24,000 mt, which assumes a stock at B_{msy}, may not be sufficient to prevent overfishing in years of moderate abundance. SAW 37 recommended that, given uncertainties in the stock distribution and population biology , the fishery should be managed in relation to the proportion of the stock on the shelf and available to US fisheries. The Council could follow this advice if the stock size and/or the proportion of the stock available to US fisheries were known in a given year. However, since for 2004 both are unknown at present, the Council concluded that the specification of the quota at 24,000 mt is not likely to result in overfishing. This conclusion is based on the observation that given recent economic and stock conditions, the fishery is unlikely to produce catches approaching 24,000 mt unless stock size begins to approach or exceed B_{msy}. If the landings were to approach 22,600 mt (the point at which the directed fishery is closed) in 2004, then the Council concludes that it is likely that stock biomass would be at or above B_{msy}. For example, since the foreign fishery was eliminated in the mid-1980's, the domestic fishery has only produced landings approaching 24,000 mt in one year - 1998. SAW 29 concluded that overfishing was unlikely to have occurred during 1994-1998 because the ***upper bound*** on the feasible estimates of fishing mortality for *Illex* for those years was ***below*** potential F_{msy} proxies. During the period 1994-1998, US landings averaged about 17, 320 mt and ranged from 13,629 mt in 1997 to 23,597 in 1998. The Council assumed that at least some of those years could be considered to be years of "moderate abundance." Yet average landings of about 75% of the level at which the directed fishery would be closed (i.e., 22,600 mt under the preferred alternative) during the period 1994-1998 resulted in fishing mortality estimates whose upper bounds of confidence were below the overfishing proxies. The Council concluded that while some chance exists that the overfishing could occur, this outcome is unlikely based on the analyses provided in SAW 29. Recent fishery performance has been poor due to low availability, poor market conditions and reduced fishing effort. The overfishing definition adopted for *Illex* squid in Amendment 8 results in setting a fixed quota for a resource that exhibits large inter-annual variability in abundance. Changes in *Illex* abundance and US landings of the species are a result of fluctuations in population size in the Northwest Atlantic Ocean, availability to the fishery in the US EEZ, and world market conditions. Ideally, the fishery would be managed on a real time basis and harvest policy would be adjusted during the fishing season according to stock conditions. Unfortunately, the current understanding of *Illex* stock dynamics and available data are insufficient to permit implementation of such a real time management system. Rather, the Council has implemented the current management program for *Illex* in the US EEZ which sets a fixed quota which, under most circumstances, prevents overfishing. This program attempts to strike a balance between minimizing the risk that overfishing might occur and minimizing the chance that yield is not foregone unnecessarily in years of high abundance. If evidence were available that the overfishing was occurring based on stock assessment data in 2004, the current FMP does allow for in-season adjustments to the quota.

In addition to specifying the quota at 24,000 mt in 2004, the Council also recommended that the non-moratorium bycatch allowance be increased to 10,000 pounds per trip. This represents an increase of 5,000 pounds per trip compared to previous non-moratorium bycatch trip limits. Overall, this recommendation is not expected to result in any negative biological consequences for the *Illex* stock since fishing mortality is controlled via the annual quota. In addition, given the relatively low economic value if *Illex*, no increases in fishing effort are expected as a result of this measure. *Illex* is a high volume, low value species which is taken offshore near the edge of the continental shelf during the summer months. The species also spoils rapidly, so either freezing or refrigerated seawater equipment is necessary to hold the catch and deliver shoreside in a marketable condition. Given the substantial capital investment required to prosecute this fishery, it is unlikely that non-moratorium vessels will increase their fishing effort as result of the increase in the bycatch allowance. Rather, this measure will allow non-moratorium vessels to retain more of the *Illex* taken as bycatch in other directed fisheries. Since this measure is not expected to increase fishing effort in the *Illex* fishery, no negative biological consequences for non target species are expected.

6.1.1.4 Alternative 1 for butterfish (2003 status quo and 2004 preferred alternative)

The specifications under this alternative would be Max OY = 16,000 mt, ABC = 7,200 mt, and IOY, DAH, and DAP = 5,900 mt and JVP and TALFF = 0 mt. These recommended specifications remain unchanged from the 2003 specifications and thus represent the status quo.

The overfishing definition for butterfish was revised in Amendment 8 to comply with the SFA as follows: overfishing is defined 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 defined as 75% of the F_{msy}

For butterfish, the yield at MSY is 16,000 mt and the yield associated with 75% F_{msy} is 12,000 mt. In making it's 2003 quota recommendation for butterfish, the Council took into consideration the advice from the recent stock assessment and also addressed concerns about butterfish discards. The Council recommended setting the annual quota at 5,900 mt primarily to allow for discards in this and other fisheries. The quota specifications recommended by the Council for 2004 for butterfish are considerably less than the yield associated with either the target or threshold fishing mortality rate specified for this stock. As a result, the Council concluded that the level of exploitation associated with the specifications under this alternative are not expected to have any negative biological effects on the butterfish stock, nor will it impact non-target species.

6.1.2 Socioeconomic Impacts

6.1.2.1 Alternative 1 for Atlantic mackerel (2003 Status Quo)

The specifications under this alternative would be ABC = 347,000 mt, IOY=175,000 mt, DAH=175,000 mt, DAP=150,000 mt and JVP=10,000 and TALFF=0 mt. They represent the 2003 status quo and least restrictive alternative for Atlantic mackerel.

The Council specified JVP in 2003 at 10,000 mt because a JVP specification at that level was necessary to allow US harvesters to take mackerel at levels in excess of current US processing capacity. The increased JVP specification recommendation since 2001 was based on the fact that US mackerel production in recent years had been far lower than historical levels, in spite of increases in world demand for mackerel and recent declines in world production.

As noted above, the status quo specification of IOY for 2003 is 175,000 mt. This is 10,000 mt greater than the preferred alternative adopted by the Council for 2004. The difference is due to a reduction in the JVP specification for the preferred alternative for 2004. The Council reduced JVP because of concerns about the impact of JVP on the shore side processing sector of this industry which underwent rapid expansion in 2002-2003. The Council felt that this level of JVP was undesirable since fish transferred at sea to foreign vessels would compete with fish landed at US shoreside facilities on the world market. However, the overall effect cannot be quantified in an economic sense. Therefore, it is not possible to determine if these specifications would result in significant negative economic and/or social impacts to the US mackerel industry.

6.1.2.2 Alternative 1 for *Loligo* (2003 status quo/no action and 2004-2006 preferred alternative)

The specifications under this alternative would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 17,000 mt and JVP and TALFF = 0 mt. In terms of the annual quota, these specifications represent the 2003 status quo (No Action - status quo). They were also adopted as the preferred alternative by the Council for 2004. In addition, Framework 2 to the FMP added a provision to allow for the specification of management measures for multiple years for *Loligo*. Therefore, the Council recommended that these specifications be maintained for 2004-2006, unless they are changed in the future during the annual quota setting procedure or by an in-season adjustment.

Since these specifications represent the status quo, no reductions in landings or revenues due to the 2004-2006 specifications are expected. Therefore, no change in economic and/or social impacts to the US *Loligo* industry are expected from this alternative. As a result, none of the vessel owners, crews, dealers, processors or fishing communities associated with the ports given in Tables 20 and 21 are expected to be significantly affected by the this alternative for the 2004-2006 annual specifications for *Loligo*. The only change to the recommendations for *Loligo* is that these measures were specified for a period of up to three years. This change is not expected to have any significant social and/or economic effects. The Council will evaluate the need for any changes in 2005 during the quota setting procedure outlined in the FMP. If no changes are warranted, then the 2004 quota specifications for *Loligo* would remain in effect in 2005.

6.1.2.3 Alternative 1 for *Illex* (2003 status quo with minor change and 2004 preferred alternative)

The specifications under this alternative would be Max OY, ABC, IOY, DAH, and DAP = 24,000 mt and JVP and TALFF = 0 mt. In addition to specifying the quota at 24,000 mt in 2004, the Council also recommended that the non-moratorium bycatch allowance be increased to 10,000 pounds per trip. These recommended specifications remain unchanged from the 2003 specifications and thus represent the status quo.

Since these specifications represent the status quo, no reductions in landings or revenues due to the 2004 specifications are expected. Therefore, no change in economic and/or social impacts to the US *Illex* industry are expected from this alternative. As a result, none of the vessel owners, crews, dealers, processors or fishing communities associated with the ports given in Tables 26 and 27 are expected to be significantly affected by the this quota alternative for the 2004 annual specifications for *Illex*. However, the proposed increase in the non-moratorium bycatch allowance to 10,000 pounds in 2004 could have some positive economic benefits for the non-moratorium sector which takes *Illex* as a bycatch.

6.1.2.4 Alternative 1for butterfish (2003 status quo and 2004 preferred alternative)

The specifications under this alternative would be Max OY = 16,000 mt, ABC = 7,200 mt, and IOY, DAH, and DAP = 5,900 mt and JVP and TALFF = 0 mt. These recommended specifications remain unchanged from the 2003 specifications and thus represent the status quo.

Since the specifications under this alternative are the same as in 2003, no reductions in landings or revenues due to the 2004 specifications are expected. Therefore, no change in economic and/or social impacts to the US butterfish industry are expected from this alternative. As a result, none of the vessel owners, crews, dealers, processors or fishing communities associated with the ports given in Tables 34 and 35 are expected to be significantly affected by the this alternative for the 2004 annual specifications for butterfish.

6.1.3 EFH Impacts

6.1.3.1 Alternative 1 for Atlantic mackerel (2003 Status Quo)

The specifications under this alternative would be ABC = 347,000 mt, IOY=185,000 mt, DAH=185,000 mt, DAP=150,000 mt and JVP=10,000 and TALFF=0 mt. They represent the 2003 status quo and least restrictive alternative for Atlantic mackerel.

As noted in Table 3, Atlantic mackerel are taken primarily with mid-water otter trawls. This gear is not expected to adversely impact essential fish habitat since it is not in contact with the seabed. In addition, since this alternative represents the 2003 status quo specification, it should not result in an increase in fishing effort or redistribute effort by gear type. As a result, this alternative for Atlantic mackerel is not expected to negatively impact essential fish habitat.

6.1.3.2 Alternative 1 for *Loligo* (2003 status quo /no action and 2004-2006 preferred alternative)

The specifications under this alternative would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 17,000 mt and JVP and TALFF = 0 mt. In terms of the annual quota, these specifications represent the 2003 status quo (No Action - status quo). They were also adopted as the preferred alternative by the Council for 2004. In addition, Framework 2 to the FMP added a provision to allow for the specification of management measures for multiple years for *Loligo*. Therefore, the Council recommended that these specifications be maintained for 2004-2006, unless they are changed in the future during the annual quota setting procedure or by an in-season adjustment.

The Sustainable Fisheries Act (SFA) of 1996 significantly altered the requirement of FMPs to address habitat issues. The SFA contains provisions for the identification and protection of habitat essential to the production of Federally managed species. The Act requires FMPs to include identification and description of essential fish habitat (EFH), description of non-fishing and fishing threats, and to suggest conservation and enhancement measures. Amendment 8 to the FMP contains descriptions and identification of essential fish habitat (summarized in section 4.2), 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.

Atlantic mackerel, squid and butterfish have EFH designated in many of the same bottom habitats that have been designated as EFH for most of the groundfish within the Northeast Multispecies FMP, including: Atlantic cod, haddock, monkfish, ocean pout, American plaice, pollock, redfish, white hake, windowpane flounder, winter flounder, witch flounder, yellowtail flounder, Atlantic halibut and Atlantic sea scallops. Broadly, EFH is designated as the bottom habitats consisting of varying substrates (depending upon species) within the Gulf of Maine, Georges Bank, and the continental shelf off southern New England and the mid-Atlantic south to Cape Hatteras for the juveniles and adults of these groundfish. In general, these areas are the same as those designated for Atlantic mackerel, squid and butterfish.

Fishing activities for Atlantic mackerel, squid and butterfish occur in these EFH areas. The primary gear utilized to harvest these species is the otter trawl. Since the otter trawl is a bottom-tending mobile gear, it is most likely to be associated with adverse impacts to bottom habitat. The primary impact associated with this type of gear is reduction of habitat complexity (Auster and Langton, 1998).

Otter trawls are the principal gear used in this fishery. In Amendment 8 , the Council concluded that, in general, bottom tending mobile gear have the potential to reduce habitat complexity and change benthic communities. Available research indicates that the effects of mobile gear are cumulative and are a function of the frequency and intensity with which an area is fished, the complexity of the benthic habitat (structure), energy of the environment (high energy and variable or low energy and stable), and ecology of the community (long-lived versus short lived).

However, the extent of an adverse impact on habitat requires high resolution data on the location of fishing effort by gear and the location of specific seafloor habitats. The Council concluded in Amendment 8 that while the otter trawls utilized in this fishery have the potential to adversely affect EFH, available effort data are currently insufficient to predict the extent of adverse impact from this fishery. However, since this alternative represents the 2003 status quo (no action - status quo) specification for *Loligo*, it should not result in an increase in fishing effort or redistribute effort by gear type. By maintaining the status quo in 2004, this alternative is not expected to increase any existing impacts on EFH caused by this fishery.

6.1.3.3 Alternative 1 for *Illex* (2003 status quo with minor change and 2004 preferred alternative)

The specifications under this alternative would be Max OY, ABC, IOY, DAH, and DAP = 24,000 mt and JVP and TALFF = 0 mt. These recommended specifications remain unchanged from the 2002 specifications and thus represent the status quo. They were also adopted as the preferred alternative for *Illex* by the Council for 2004.

Otter trawls are the principal gear used in this fishery. In Amendment 8, the Council concluded that, in general, bottom tending mobile gear have the potential to reduce habitat complexity and change benthic communities. Available research indicates that the effects of mobile gear are cumulative and are a function of the frequency and intensity with which an area is fished, the complexity of the benthic habitat (structure), energy of the environment (high energy and variable or low energy and stable), and ecology of the community (long-lived versus short lived). However, the extent of an adverse impact on habitat requires high resolution data on the location of fishing effort by gear and the location of specific seafloor habitats. The Council concluded in Amendment 8 that while the otter trawls utilized in this fishery have the potential to adversely affect EFH, available effort data are currently insufficient to predict the extent of adverse impact from this fishery. However, since this alternative represents the 2003 status quo specification for *Illex*, it should not result in an increase in fishing effort or redistribute effort by gear type. Therefore, by maintaining the status quo in 2004, this alternative is not expected to increase any existing impacts on EFH caused by this fishery.

In addition to specifying the quota at 24,000 mt in 2004, the Council also recommended that the non-moratorium bycatch allowance be increased to 10,000 pounds per trip. This represents an increase of 5,000 pounds per trip compared to previous non-moratorium bycatch trip limits. Overall, this recommendation is not expected to result in any increases in fishing effort. *Illex* is a high volume, low value species which is taken offshore near the edge of the continental shelf during the summer months. The species also spoils rapidly, so either freezing or refrigerated seawater equipment is necessary to hold the catch and deliver it shoreside in a marketable condition. Given the substantial capital investment required to prosecute this fishery, it is unlikely that non-moratorium vessels will increase their fishing effort as result of the increase in the bycatch allowance. Rather, this measure will allow non-moratorium vessels to retain more of the *Illex* taken as bycatch in other directed fisheries. Since this measure is not expected to increase fishing effort in the *Illex* fishery, this alternative is not expected to increase any existing impacts on EFH caused by this fishery.

6.1.3.4 Alternative 1 for butterfish (2003 status quo and 2004 preferred alternative)

The specifications under this alternative would be Max OY = 16,000 mt, ABC = 7,200 mt, and IOY, DAH, and DAP = 5,900 mt and JVP and TALFF = 0 mt. These recommended specifications remain unchanged from the 2003 specifications and thus represent the status quo.

Otter trawls are the principal gear used in this fishery. In Amendment 8, the Council concluded that, in general, bottom tending mobile gear have the potential to reduce habitat complexity and change benthic communities. Available research indicates that the effects of mobile gear are cumulative and are a function of the frequency and intensity with which an area is fished, the complexity of the benthic habitat (structure), energy of the environment (high energy and variable or low energy and stable), and ecology of the community (long-lived versus short lived). However, the extent of an adverse impact on habitat requires high resolution data on the location of fishing effort by gear and the location of specific seafloor habitats. The Council concluded in Amendment 8 that while the otter trawls utilized in this fishery have the potential to adversely affect EFH, available effort data are currently insufficient to predict the extent of adverse impact from this fishery. However, since this alternative represents the 2003 status quo specification for butterfish, it should not result in an increase in fishing effort or redistribute effort by gear type. Therefore, by maintaining the status quo in 2004, this alternative is not expected to increase any existing impacts on EFH caused by this fishery.

6.1.4.3 Impacts on Protected Resources

The Protected resource species which are found within the general area of the management unit of this FMP are fully described in section 4.3. Several species groups are of particular concern. The first group includes the species listed as endangered under the Endangered Species Act. There are six species of large whales which are listed as endangered under the ESA: the northern right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*), blue whale (*Balaenoptera musculus*), sei whale (*Balaenoptera borealis*), and sperm whale (*Physeter macrocephalus).* The most prominent species in this group is the north Atlantic right whale, which is the most endangered large whale in the world. While fishery interactions are a major concern relative to the survival of this species, the Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries are not known to interact with right whales. Likewise, there are no known interactions between these fisheries and any of the other large whales listed as endangered that are found in US EEZ.

In addition to the large whales, there are nine other species found within the management unit of the FMP which are listed as endangered under the Endangered Species Act . These include five species of sea turtles: the leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), and loggerhead sea turtle (*Caretta caretta*); two species of fish: the shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic salmon (*Salmo salar*); and two species of birds: the roseate tern (*Sterna dougallii dougallii*) and piping plover (*Charadrius melodus*). None of these endangered are known to interact with the Atlantic mackerel, *Illex* squid or butterfish fisheries. However, preliminary examination of observer coverage data pertaining to turtle bycatch in Mid-Atlantic trawl fisheries for 2001 indicated that one leatherback turtle was taken off New Jersey in October in gear targeting *Loligo* squid. In 2002, five turtles were taken in fisheries targeting *Loligo* squid during September and October off the coasts of New Jersey and Rhode Island (unpublished NMFS observer data). An estimate of the total bycatch of these species is not presently available.

Finally, there are eight additional groups of cetaceans found within the management unit of the FMP which are protected under the Marine Mammal Protection Act. These include the Minke whale (*Balaenoptera acutorostrata*), beaked whales (*Ziphius and Mesoplodon spp*.), Risso's dolphin (*Grampus griseus*), pilot whales (*Globicephala spp*.), white-sided dolphin (*Lagenorhynchus acutus*), common dolphin (*Delphinus delphis*), spotted and striped dolphins (*Stenella spp*.), and bottlenose dolphin (*Tursiops truncatus*). Within this group, three species are of particular concern because they have been documented as interacting with the

Atlantic mackerel, squid and butterfish trawl fishery as defined under the MMPA. These include common dolphin, white-sided dolphin and pilot whales. NMFS plans on covening aTake Reduction Team for the Atlantic trawl fishery, which will include the Atlantic mackerel squid and butterfish trawl fisheries in the summer of 2006. The purpose of this team will be to reduce the take of common dolphin and pilot whales in these fisheries.

6.1.4.3.1 Alternative 1 for Atlantic mackerel (2003 Status Quo)

The specifications under this alternative would be ABC = 347,000 mt, IOY=185,000 mt, DAH=185,000 mt, DAP=150,000 mt and JVP=10,000 and TALFF=0 mt. They represent the 2003 status quo and least restrictive alternative for Atlantic mackerel.

There are two sources of information relative to fishery interactions in the Atlantic mackerel, squid and butterfish trawl fishery. After passage of the Magnuson Fisheries Conservation and Management Act (MFCMA), an observer program was established which recorded fishery data and information on incidental bycatch of marine mammals in the distant water foreign (DWF) fisheries which operated in the US EEZ. In addition, data on recent incidental takes in USA fisheries are available from several sources (see section 4.3). From 1977-1991, observers recorded 110 common dolphin mortalities in the foreign Atlantic mackerel fishery. Most of these mortalities occurred during the winter and spring (Waring *et al.* 2003). Recent domestic data indicate that there were 11 common dolphin mortalities observed in the Atlantic mackerel, squid and butterfish trawl fishery. Only one of these mortalities was attributed to the Atlantic mackerel sub-fishery. From 1977-1991, 96% of the 44 white-sided dolphin mortalities observed in the foreign Atlantic mackerel, squid and butterfish fishery were attributed to the mackerel fishery. There was one white-sided dolphin mortality observed in the domestic Atlantic mackerel fishery during the period 1996-2000. From 1977-1991, observers recorded 436 pilot whale mortalities in the foreign Atlantic mackerel, squid and butterfish fisheries. Most (391 or 90%) of these mortalities were observed in the winter and spring Atlantic mackerel fishery (Waring *et al.* 2003).

Based on the analysis of observed mortalities given in Waring *et al.* (2003), the two cetacean species of primary concern in the prosecution of the Atlantic mackerel fishery include common dolphins and pilot whales. As noted above, this alternative represents implementation of the 2003 status quo for the 2004 specifications. As a result, this alternative is not expected to increase fishing effort or redistribute effort by gear type. Therefore, the implementation of this alternative is not expected to impact protected species described in section 4.3 relative to 2003 specifications for Atlantic mackerel.

6.1.4.3.2 Alternative 1 for *Loligo* (2003 status quo - no action/status quo and 2004 preferred alternative)

The specifications under this alternative would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 17,000 mt and JVP and TALFF = 0 mt. In terms of the annual quota, these specifications represent the 2003 status quo (No Action - status quo).

There are two sources of information relative to fishery interactions in the Atlantic mackerel, squid and butterfish trawl fishery. After passage of the Magnuson Fisheries Conservation and Management Act (MFCMA), an observer program was established which recorded fishery data and information on incidental bycatch of marine mammals in the distant water foreign (DWF) fisheries which operated in the US EEZ. In addition, data on recent incidental takes in USA fisheries are available from several sources (see section 4.3). From 1977-1991, observers recorded 110 common dolphin mortalities in the foreign Atlantic mackerel fishery. Most of these mortalities occurred during the winter and spring (Waring *et al.* 2003). Recent domestic data indicate that there were 11 common dolphin mortalities observed in the Atlantic mackerel, squid and butterfish trawl fishery. Nine of these mortalities were attributed to the *Loligo* sub-fishery. From 1977-1991, 96% of the 44 white-sided dolphin mortalities observed in the foreign Atlantic mackerel, squid and butterfish fishery were attributed to the mackerel fishery. There were no white-sided dolphin mortalities observed in the domestic *Loligo* fishery during the period 1996-2000. From 1977-1991, observers recorded 436 pilot whale mortalities in the foreign Atlantic mackerel, squid and butterfish fisheries. 41 or 9% of these mortalities were observed in the *Loligo* and *Illex* squid fisheries (Waring *et al.* 2003).

Based on an analysis of available observer data, the cetacean of primary concern relative to the prosecution of the *Loligo* fishery is the common dolphin, and to a lesser extent, the pilot whale. NMFS intends on convening a take reduction team which will develop measures to reduce the take of common dolphins and pilot whales in offshore Atlantic trawl fisheries, including the *Loligo* fishery. While the significance of the impact on these cetacean stocks by the Loligo fishery is currently unknown, the specifications under the preferred for 2004-2006 are not expected to increase fishing effort or redistribute effort by gear type. As such, the implementation of this alternative is not expected to have a significant impact on the protected species described in section 4.3 relative to 2003 specifications for *Loligo*.

6.1.4.3.3 Alternative 1for *Illex* (2003 status quo and 2004 preferred alternative)

There are two sources of information relative to fishery interactions in the Atlantic mackerel, squid and butterfish trawl fishery. After passage of the Magnuson Fisheries Conservation and Management Act (MFCMA), an observer program was established which recorded fishery data and information on incidental bycatch of marine mammals in the distant water foreign (DWF) fisheries which operated in the US EEZ. In addition, data on recent incidental takes in USA fisheries are available from several sources (see section 4.3). From 1977-1991, observers recorded 436 pilot whale mortalities in the foreign Atlantic mackerel, squid and butterfish fisheries. 41 or 9% of these mortalities were observed in the *Loligo* and *Illex* squid fisheries (Waring *et al.* 2003).

The specifications under this alternative would be Max OY, ABC, IOY, DAH, and DAP = 24,000 mt and JVP and TALFF = 0 mt. These recommended specifications remain unchanged from the 2003 specifications and thus represent the status quo. They were also adopted as the preferred alternative by the Council for 2004. Based on an analysis of available observer data, the cetacean of primary concern relative to the prosecution of the *Illex* fishery is the pilot whale. NMFS intends on convening a take reduction team which will develop measures to reduce the take of common dolphins and pilot whales in offshore Atlantic trawl fisheries, including the *Illex* fishery. While the significance of the impact on these cetacean stocks by the *Illex* fishery is currently unknown, the specifications under the preferred alternative for 2004 are not expected to increase fishing effort or redistribute effort by gear type. As such, the implementation of this alternative is not expected to impact the protected species described in section 4.3 relative to 2003 specifications for *Illex.*

6.1.4.3.4 Alternative 1 for butterfish (2003 status quo and 2004 preferred alternative)

The specifications under this alternative would be Max OY = 16,000 mt, ABC = 7,200 mt, and IOY, DAH, and DAP = 5,900 mt and JVP and TALFF = 0 mt. These recommended specifications remain unchanged from the 2003 specifications and thus represent the status quo.
They were also adopted as the preferred alternative by the Council for 2004. This alternative is not expected to increase fishing effort or redistribute effort by gear type. As such, the implemen-

tation of this alternative is not expected to impact the protected species described in section 4.3 relative to 2003 specifications for butterfish.

6.2 Impacts of Alternative 2 on the Environment (Preferred Alternative for Atlantic mackerel and least restrictive for *Loligo*, *Illex* and Butterfish)

6.2.1 Biological Impacts

6.2.1.1 Alternative 2 for Atlantic mackerel (preferred alternative)

The specifications under the preferred alternative for Atlantic mackerel in 2004 would be ABC = 347,000 mt, IOY=170,000 mt, DAH=170,000 mt, DAP=150,000 mt, JVP=5,000 mt and TALFF=0 mt. That is, the amount of mackerel taken by US vessels and transferred over the side to foreign vessels, whether in state or federal waters, should not exceed the amount specified for JVP. This was the preferred alternative adopted by the Council for Atlantic mackerel for 2004. In addition, Council recommend the following special provisions: 1) joint ventures are allowed south of 37° 30' N. latitude, but the river herring bycatch south of that latitude may not exceed 0.25% of the over the side transfers of Atlantic mackerel 2) the Regional Administrator should do everything within his/her power to reduce impacts on marine mammals in prosecuting the Atlantic mackerel fisheries 3) the mackerel OY may be increased during the year, but the total should not exceed 347,000 mt and 4) applications from a particular foreign nation for a mackerel Joint Venture allocation in 2004 may be decided based on an evaluation by the Regional Administrator of the nation's performance relative to purchase obligations for previous years.

The ABC specification is based on yield projections at F=0.25 at the most recent estimate of stock size as described in the section above. The 2004 DAP specification is th same as the 2003 specification(150,000 mt). The the 2003 specification represented a three fold increase in the DAP specification compared to specifications in previous years was based on testimony from members of the harvesting and processing sectors of the Atlantic mackerel industry who indicated that there was significant interest in expansion of domestic shore-side processing for mackerel in 2003. For example, one processor alone expected to increase processing capacity for mackerel to over 50,000 mt in 2003. Other processors expected lesser, yet substantial (i.e., 10,000 mt or greater) increases in their plant capacity to process mackerel in 2003. This increase in DAP was consistent with the current FMP. The Council concluded that the recent increase in shore side processing was likely to continue or be maintained in the near future and therefore, recommended that DAP be maintained at 150,000 mt in 2004.

The biological basis for the annual quota stems from the control rule for mackerel developed in Amendment 8 (i.e., it forms the basis for calculation of ABC for this species). As noted above, the specification of IOY under this alternative is 170,000 mt. This level of exploitation is not expected to have a negative biological effect on the Atlantic mackerel stock. The overfishing definition adopted for Atlantic mackerel in Amendment 8 is designed to protect the stock from overfishing and was developed to comply with the Sustainable Fisheries Act. Based on the current condition of the stock, an IOY specification of 170,000 mt is considerably less than the yield associated with either the target or threshold fishing mortality rate specified for this stock based on the Amendment 8 overfishing definition. In other words, population modeling of the Atlantic mackerel stock dynamics indicate that the safe level of removals from the current mackerel stock size is considerably higher than the level proposed under this alternative. As a result, the Council concluded that the level of exploitation associated with an IOY of 170,000 mt is not expected to have any significant biological effects on the Atlantic mackerel stock. In addition, this IOY specification is not expected to significantly impact non-target species that prey on Atlantic mackerel since assumptions about natural mortality are made implicitly in the calculation of MSY. That is, the allowable fishery yields at the biological reference points defined in the FMP are *in addition to* assumed mortality due to natural causes, including mortality due to predation.

6.2.1.2 Alternative 2 for *Loligo* (least restrictive alternative)

The specifications under this alternative would be Max OY =20,000 mt, ABC, IOY, DAH, and DAP = 18,300 mt and JVP and TALFF = 0 mt. These specifications are consistent with recommendations of SARC-30 which considered the considered the current *Loligo* overfishing definition to be inappropriate for a short-lived species. SARC-30 proposed a new set of biological reference points for *Loligo* based on the average catch and landings during the period 1987-1999. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for *Loligo* which was considered by the Council.

While the specification of ABC under this alternative is consistent with the recommendations of SARC-30, it is not consistent with the current overfishing definition specified in the FMP. The specification under this alternative would be 1,300 mt higher than allowed under current regulations. A higher quota could result in increased fishing effort. Therefore, this alternative could result in negative biological impacts for *Loligo* squid. The degree of the impact would depend upon the level of *Loligo* abundance in any given year.

6.2.1.3 Alternative 2 for *Illex* (least restrictive alternative)

The specifications under this alternative would be Max OY, ABC, IOY, DAH, and DAP = 30,000 mt and JVP and TALFF = 0 mt. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for *Illex* which was considered by the Council.

The specification of ABC at 30,000 mt may not prevent overfishing in years of moderate to low abundance of *Illex* squid. This would have a negative biological 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.

6.2.1.4 Alternative 2 for butterfish (least restrictive alternative)

The specifications under this alternative would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 10,000 mt and JVP and TALFF = 0 mt. This set of specifications for butterfish is consistent with overfishing definition, but not with the most recent assessment advice for butterfish. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for butterfish which was considered by the Council.

The definition of overfishing for butterfish in the FMP specifies overfishing as the fishing mortality rate of F_{msy}. The yield associated with F_{msy} is 16,000 mt. The target fishing mortality rate specified in the FMP is 75% F_{msy}. Therefore, based on the target fishing mortality rate specified in the FMP, annual quotas as high as 12,000 mt could be specified. A quota of 10,000 mt was considered to take into account discards of butterfish. However, the Council rejected this option based on the advice given in the most recent assessment. This level of landings could have a negative biological impact on the butterfish stock based on the findings of the most recent assessment.

6.2.2 Socioeconomic Impacts

6.2.2.1 Alternative 2 for Atlantic mackerel (preferred alternative)

The specifications under the preferred alternative for Atlantic mackerel in 2004 would be ABC = 347,000 mt, IOY=170,000 mt, DAH=170,000 mt, DAP=150,000 mt, JVP=5,000 mt and TALFF=0 mt.

The ABC specification is based on yield projections at F=0.25 at the most recent estimate of stock size as described in the section above. This alternative maintains the 2003 specification of DAP which represented a three fold increase in the DAP specification compared to DAP specifications in previous years. This increase was based on testimony from members of the harvesting and processing sectors of the Atlantic mackerel industry who indicated that there was significant interest in expansion of domestic shore-side processing for mackerel in 2003. For example, one processor alone expected to increase processing capacity for mackerel to over 50,000 mt in 2003. Other processors expected lesser, yet substantial (i.e., 10,000 mt or greater) increases in their plant capacity to process mackerel in 2003. The increase in DAP for 2003 was consistent with the current FMP. The Council concluded that the recent increase in shore side processing was likely to continue or be maintained in the near future and therefore, recommended that DAP be maintained at 150,000 mt in 2004.

The IOY specification for 2004 under this alternative represents represents a slight (3%) decrease relative to the IOY specified in 2003 for mackerel. The slight decrease in IOY under this alternative was due to an decrease in the JVP specification. Since the proposed IOY specification under this alternative would accommodate increased levels of processing without requiring an in-season adjustment, no reductions in landings or revenues due to the proposed 2004 specifications for mackerel would be expected. As a result, the vessel owners, crews, dealers, processors and or fishing communities associated with the ports given in Table 4 and 5 are expected to be positively affected by the this alternative for the 2004 annual specifications for Atlantic mackerel. This should yield positive social and economic benefits to the ports and communities which are dependent upon Atlantic mackerel. The decrease in the JVP specification for 2004 is not expected to significantly affect vessels since this reduced level still exceeds JV landings in recent years. The Council concluded that replacement of JV processing with US shore side processing would result in an overall increase in economic and social benefits to the mackerel fishery and to the Nation.

The Council proposes a TALFF specification for 2004 of zero. This TALFF recommendation is based on the testimony of members of the US mackerel industry (both processors and harvesters), that US mackerel processing capacity in future years may increase dramatically. Thus, the US industry believes that in spite of the fact that recent US mackerel production has been far lower than historical levels under conditions of increased world demand for mackerel and recent declines in production, increases in US production are occuring and will continue because of expansion in the processing sector. The Council believes any allocation of TALFF would have a negative impact on the expansion of the domestic mackerel processing and harvest sector.

The Magnuson-Stevens Act provides that the specification of TALFF, if any, shall be that portion of the optimum yield of a fishery which will not be harvested by vessels of the United States. While a surplus exists between ABC and DAH, the Council is concerned that the current estimate of ABC for Atlantic mackerel may be overly optimistic. The current estimate of ABC is based upon a stock size estimate that is nearly ten years old. Given the uncertainty in the extant estimates of mackerel stock size, the Council is concerned that mackerel harvests should probably not exceed 150,000 - 200,000 mt. This concern is based on advice received is the past from the Northeast Fisheries Science Center in the face of uncertainty about the status of the Atlantic mackerel stock. In past years, the NEFSC issued a special advisory to the Council that mackerel harvests should probably not exceed 150,000 - 200,000 mt, since overfishing of this stock occurred in the 1970's when mackerel landings exceeded these levels. In light of that advice, the Council concluded that no surplus may exist between the true potential production level for mackerel and the IOY for 2004 and, therefore, that TALFF should be specified at zero. In addition, the term optimum yield under the Magnuson-Stevens Act means the amount of fish which will provide the provide the greatest overall benefit to the Nation with respect to food production and recreation, taking into account the protection of marine ecosystems. The Council has proposed an IOY specification of 170,000 mt. The Council believes that this level of yield will provide the greatest overall benefit to the nation. Based on this analysis and a review of the state of the world mackerel market and possible increases in US production levels, the Council concluded that the specification of zero TALFF will yield positive social and economic benefits to the mackerel fishery and to the Nation.

Because the Council recommended that TALFF be set at zero, the economic benefit to the nation is reduced relative to the 2001 TALFF specification (3,000 mt). Foreign vessels fishing in the US EEZ for Atlantic mackerel must pay fees based on the mt of mackerel harvested. For Atlantic mackerel, the poundage fee paid to the nation is $64.76 per mt. In 2001, TALFF was specified at 3000 mt. Assuming the entire TALFF allocation is harvested, almost $195,000 in fees would have been collected for the nation. In addition, TALFF operations are often brokered by a US representative. Although the amount of income gained by the US broker is unknown, this income will also be lost with the elimination of TALFF in the 2004 fishing year.

6.2.2.2 Alternative 2 for *Loligo* (least restrictive alternative)

The specifications under this alternative would be Max OY =20,000 mt, ABC, IOY, DAH, and DAP = 18,300 mt and JVP and TALFF = 0 mt. These specifications are consistent with recommendations of SARC-34 which considered the considered the current *Loligo* overfishing definition to be inappropriate for a short-lived species. SARC-34 proposed a new set of biological reference points for *Loligo* based on the average catch and landings during the period 1987-1999. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for *Loligo* which was considered by the Council.

While the specification of ABC under this alternative is consistent with the recommendations of SARC-34, it is not consistent with the current overfishing definition specified in the FMP. Under this alternative, the quota would be specified at level that is 1,300 mt higher than is specified by the overfishing definition control rule in the FMP. Since the stock is technically not protected from overfishing, some negative economic and social impacts could be expected from this alternative in the long term if the stock did become overfished. Table 20 lists the ports which landed *Loligo* in 2002. The vessel owners, crews, dealers, processors and fishing communities associated with these ports would be expected to be affected the most by this alternative to the 2004 annual specifications for *Loligo*.

6.2.2.3 Alternative 2 for *Illex* (least restrictive alternative)

The specifications under this alternative would be Max OY, ABC, IOY, DAH, and DAP = 30,000 mt and JVP and TALFF = 0 mt. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for *Illex* which was considered by the Council.

The specification of ABC at 30,000 mt may not prevent overfishing in years of moderate to low abundance of *Illex* squid. This would have a negative biological impact on the *Illex* stock. Since the stock is not protected from overfishing, some negative economic and social impacts could be expected from quota specifications under this alternative for *Illex* in 2004. Table 26 lists the ports which landed *Illex* in 2002. The vessel owners, crews, dealers, processors and fishing communities associated with these ports would be expected to be affected the most by this alternative to the 2004 annual specifications for *Illex*.

6.2.2.4 Alternative 2 for butterfish (least restrictive alternative)

The specifications under this alternative would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 10,000 mt and JVP and TALFF = 0 mt. This set of specifications for butterfish is consistent with overfishing definition, but not with the most recent assessment advice for butterfish. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for butterfish which was considered by the Council.

The definition of overfishing for butterfish in the FMP specifies overfishing as the fishing mortality rate of F_{msy}. The yield associated with F_{msy} is 16,000 mt. The target fishing mortality rate specified in the FMP is 75% F_{msy}. Therefore, based on the target fishing mortality rate specified in the FMP, annual quotas as high as 12,000 mt could be specified. A quota of 10,000 mt was considered to take into account discards of butterfish. However, the Council rejected this option based on the advice given in the most recent assessment. This level of landings could have a negative biological impact on the butterfish stock based on the findings of the most recent assessment. Since the stock is not protected from overfishing, some negative economic and social impacts could be expected from quota specifications under this alternative for butterfish in 2004. Table 34 lists the ports which landed butterfish in 2002. The vessel owners, crews, dealers, processors and fishing communities associated with these ports would be expected to be affected the most by this alternative to the 2004 annual specifications for butterfish.

6.2.3 EFH Impacts

6.2.3.1 Alternative 2 for Atlantic mackerel (Preferred Alternative)

The specifications under the preferred alternative for Atlantic mackerel in 2004 would be ABC = 347,000 mt, IOY=170,000 mt, DAH=170,000 mt, DAP=150,000 mt, JVP=5,000 mt and TALFF=0 mt.

As noted in Table 3, Atlantic mackerel are taken primarily with mid-water otter trawls. This gear is not expected to adversely impact essential fish habitat since it is not in contact with the seabed. In addition, since this alternative represents a decrease in IOY relative to the 2003 status quo specification of IOY, the specifications should not result in an increase in fishing effort or redistribute effort by gear type. As a result, this alternative for Atlantic mackerel is not expected to negatively impact essential fish habitat.

6.2.3.2 Alternative 2 for *Loligo* (least restrictive alternative)

The specifications under this alternative would be Max OY =20,000 mt, ABC, IOY, DAH, and DAP = 18,300 mt and JVP and TALFF = 0 mt. These specifications are consistent with recommendations of SARC-30 which considered the current *Loligo* overfishing definition to be inappropriate for a short-lived species. SARC-30 a new set of biological reference points for *Loligo* based on the average catch and landings during the period 1987-1999. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for *Loligo* which was considered by the Council.

Otter trawls are the principal gear used in this fishery. In general, bottom tending mobile gear have the potential to reduce habitat complexity and change benthic communities. Available research indicates that the effects of mobile gear are cumulative and are a function of the frequency and intensity with which an area is fished, the complexity of the benthic habitat (structure), energy of the environment (high energy and variable or low energy and stable), and ecology of the community (long-lived versus short lived). The extent of an adverse impact on habitat requires high resolution data on the location of fishing effort by gear and the location of specific seafloor habitats. While the otter trawls utilized in this fishery have the potential to adversely affect EFH, available effort data are currently insufficient to predict the extent of adverse impact from this fishery. However, the specifications for *Loligo* under this alternative could result in an increase in fishing effort or redistribute effort by gear type. As a result, this alternative for *Loligo* could negatively impact essential fish habitat relative to the status quo.

6.2.3.3 Alternative 2 for *Illex* (least restrictive alternative)

The specifications under this alternative would be Max OY, ABC, IOY, DAH, and DAP = 30,000 mt and JVP and TALFF = 0 mt. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for *Illex* which was considered by the Council.

Otter trawls are the principal gear used in this fishery. In general, bottom tending mobile gear have the potential to reduce habitat complexity and change benthic communities. Available research indicates that the effects of mobile gear are cumulative and are a function of the frequency and intensity with which an area is fished, the complexity of the benthic habitat (structure), energy of the environment (high energy and variable or low energy and stable), and ecology of the community (long-lived versus short lived). The extent of an adverse impact on habitat requires high resolution data on the location of fishing effort by gear and the location of specific seafloor habitats. While the otter trawls utilized in this fishery have the potential to adversely affect EFH, available effort data are currently insufficient to predict the extent of adverse impact from this fishery. However, the specifications for *Illex* under this alternative could result in an increase in fishing effort or redistribute effort by gear type. Therefore, this alternative for *Illex* could negatively impact essential fish habitat relative to the status quo.

6.2.3.4 Alternative 2 for butterfish (least restrictive alternative)

The specifications under this alternative would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 10,000 mt and JVP and TALFF = 0 mt. This set of specifications for butterfish is consistent with overfishing definition, but not with the most recent assessment advice for butterfish. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for butterfish which was considered by the Council.

Otter trawls are the principal gear used in this fishery. In general, bottom tending mobile gear have the potential to reduce habitat complexity and change benthic communities. Available research indicates that the effects of mobile gear are cumulative and are a function of the frequency and intensity with which an area is fished, the complexity of the benthic habitat (structure), energy of the environment (high energy and variable or low energy and stable), and ecology of the community (long-lived versus short lived). The extent of an adverse impact on habitat requires high resolution data on the location of fishing effort by gear and the location of specific seafloor habitats. While the otter trawls utilized in this fishery have the potential to adversely affect EFH, available effort data are currently insufficient to predict the extent of adverse impact from this fishery. However, the specifications for butterfish under this alternative could result in an increase in fishing effort or redistribute effort by gear type. Therefore, this alternative for butterfish could negatively impact essential fish habitat relative to the status quo.

6.2.4 Protected Resources Impacts

6.2.4.1 Alternative 2 for Atlantic mackerel (Preferred Alternative and least restrictive)

The specifications under the preferred alternative for Atlantic mackerel in 2004 would be ABC = 347,000 mt, IOY=170,000 mt, DAH=170,000 mt, DAP=150,000 mt, JVP=5,000 mt and TALFF=0 mt. The ABC specification is based on yield projections at F=0.25 at the most recent estimate of stock size and is the same as the level specified in 2003. Therefore, relative to the ABC specification, this level of exploitation is not expected to have a negative biological effect on the Atlantic mackerel stock. It is difficult to predict what effect these specifications will have on fishing effort in the Atlantic mackerel fishery. Since no increase in fishing effort is expected to occurr as a result of this alternative, then no negative biological impacts are expected for non-target species, including protected species described in section 4.

ESA-listed cetaceans and others protected under the MMPA (described in section 4.3) may occur in areas where the Atlantic mackerel fishery operates. The U.S. commercial Atlantic mackerel fishery takes place over the mid-Atlantic shelf region from Cape Hatteras to southern New England primarily during December through May as the species migrate. Smaller coastal fisheries work the stocks within the Gulf of Maine from May-December. Mid-water trawl gear is the primary gear type for the Atlantic mackerel fishery. ESA-listed cetaceans may be present in mid-Atlantic and New England waters year round but most animals move in the late fall to more southern locations for mating and/or calving or disperse farther offshore. Mid-Atlantic waters are used as a migratory pathway in the spring as right whales and humpback whales return from their wintering calving areas in the south. Most species of ESA-listed cetaceans, including right, humpback, fin and sperm whales are observed in southern New England waters by March-April. Right, humpback, and fin whales are also observed in Gulf of Maine waters throughout the summer. Of these species, humpback and fin whales are most likely to be affected by the Atlantic mackerel fishery since both species are known to prey on Atlantic mackerel. The most recent Northwest Atlantic mackerel stock assessment was 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. The adult stock biomass remains constant at 800,000 mt and the appearance of one and two year old fish indicates that two very large classes are entering the fishery. And so, the stock is capable of sustaining any likely increase in fishing effort from this action. Furthermore, the action will not deplete the food source to such an extent that any whales who compete for the food resource will be adversely affected. In addition, these whales may be attracted to domestic vessels as they transfer their catch to a JVP, as has been seen in other fisheries. However, records suggest that mid-water trawl gear does not pose a significant entanglement risk to these ESA-listed cetaceans, and there is no information on ESA-listed cetaceans interacting with this fishery as mackerel is being transferred from a domestic vessel to a JVP. Observation records for the time period (1994 to 2001) show there were no known interactions between the Atlantic mackerel fishery and ESA-listed cetacean species.

Sea turtle distribution also overlaps with the operation of the Atlantic mackerel fishery. Sea turtles typically occur in southern waters or at the southern limit of mid-Atlantic waters throughout the winter, and migrate up the coast to southern New England waters in the spring as water temperatures increase. However, most of these species, including green, Kemp's ridley and loggerhead sea turtles, stay close to the coast feeding on bottom dwelling species (i.e., crabs) or vegetation where the mackerel fishery is less likely to occur. Leatherbacks do not prey on mackerel and are unlikely to be attracted to operations of this fishery. While, loggerheads do not typically prey on fish species, and are unlikely to catch or target fast moving fish such as mackerel. Thus, the chance of interactions between sea turtles and the inshore Atlantic mackerel fishery is not anticipated. While in waters farther offshore where the predominant sea turtle species are leatherbacks and larger loggerheads the interaction possibilities may be greater. Observation data from 1994 to 2001 show no interactions have occurred between the mackerel sink gillnet and otter trawl fishery and endangered cetaceans or sea turtles.

6.2.4.2 Alternative 2 for *Loligo* (least restrictive alternative)

The specifications under this alternative would be Max OY =20,000 mt, ABC, IOY, DAH, and DAP = 18,300 mt and JVP and TALFF = 0 mt. These specifications are consistent with recommendations of SARC-30 which considered the considered the current *Loligo* overfishing definition to be inappropriate for a short-lived species. SARC-30 proposed a new set of biological reference points for *Loligo* based on the average catch and landings during the period 1987-1999. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for *Loligo* which was considered by the Council.

While the specification of ABC under this alternative is consistent with the recommendations of SARC-30, it is not consistent with the current overfishing definition specified in the FMP. Under this alternative, the quota would be specified at level that is 1,300 mt higher than is specified by the overfishing definition control rule in the FMP. As a result, this alternative could result in an increase fishing effort. As such, the implementation of this alternative could have a greater impact on the protected species described in section 4.3 relative to 2003 specifications for *Loligo*. Based on the analysis presented in section 6.1.4.3.2, the protected species cetacean of primary concern in the *Loligo* fishery is the common dolphin. In addition, recent unpublished NMFS observer data indicate that loggerhead and leatherback seaturtles been taken incidentally in the *Loligo* fishery. It is currently unknown if the impacts of the Loligo fishery on these species under this alternative would be significant.

6.2.4.3 Alternative 2 for *Illex* (least restrictive alternative)

The specifications under this alternative would be Max OY, ABC, IOY, DAH, and DAP = 30,000 mt and JVP and TALFF = 0 mt. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for *Illex* which was considered by the Council.

Under this alternative, the quota would be specified at level that is 8,000 mt higher than is specified by the overfishing definition control rule in the FMP. As a result, this alternative could result in an increase fishing effort. As such, the implementation of this alternative could have a greater impact on the protected species described in section 4.3 relative to 2003 specifications for *Illex.* Based on the analysis presented in section 6.1.4.3.3, the protected species cetacean of primary concern in the *Illex* fishery are the pilot whales. However, it is currently unknown if the impacts of the *Illex* fishery on these species under this alternative would be significant.

6.2.4.4 Alternative 2 for butterfish (least restrictive alternative)

The specifications under this alternative would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 10,000 mt and JVP and TALFF = 0 mt. This set of specifications for butterfish is consistent with overfishing definition, but not with the most recent assessment advice for butterfish. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for butterfish which was considered by the Council.

Under this alternative, the quota would be specified at level that is higher than was specified in 2003 based on management advice from the most recent assessment. As a result, this alternative could result in an increase fishing effort. Therefore, the implementation of this alternative could have a greater impact on the protected species described in section 4.3 relative to 2003 specifications for butterfish.

6.3 Impacts of Alternative 3 on the Environment (most restrictive alternative for Atlantic mackerel, *Loligo* and *Illex*)

6.3.1 Biological Impacts

6.3.1.1 Alternative 3 for Atlantic mackerel (most restrictive)

The third alternative action considered by the Council for Atlantic mackerel in 2003 was to specify ABC at long term potential catch. The most recent estimate of LTPC was 134,000 mt. Therefore, the specifications under this alternative would be ABC=134,000 mt, IOY=85,000 mt, DAH=85,000 mt, DAP=50,000 mt and JVP=20,000 and TALFF=0 mt.

The use of LTPC as an upper bound on ABC was found to be inappropriate because it would not allow for variations and contingencies in the status of the stock. For example, the current adult stock was recently estimated to exceed 2.1 million mt. The specification of ABC at LTPC would effectively result in an exploitation rate of only about 6%, well below the optimal level of exploitation. The potential level of foregone yield under this alternative was considered unacceptable.

The biological basis for the annual quota stems from the control rule for mackerel developed in Amendment 8 (i.e., it forms the basis for calculation of ABC for this species). As noted above, the specification of IOY under this alternative is 134,000 mt. This level of exploitation is not expected to have a negative biological effect on the Atlantic mackerel stock. The overfishing definition adopted for Atlantic mackerel in Amendment 8 is designed to protect the stock from overfishing and was developed to comply with the Sustainable Fisheries Act. Based on the current condition of the stock, an IOY specification of 134,000 mt is considerably less than the yield associated with either the target or threshold fishing mortality rate specified for this stock based on the Amendment 8 overfishing definition, given the current status of the stocks. In other words, population modeling of the Atlantic mackerel stock dynamics indicate that the safe level of removals from the current mackerel stock size is considerably higher than the level proposed under this alternative. As a result, the Council concluded that the level of exploitation associated with an IOY of 134,000 mt is not expected to have any significant biological effects on the Atlantic mackerel stock. In addition, this IOY specification is not expected to significantly impact non-target species that prey on Atlantic mackerel since assumptions about natural mortality are made implicitly in the calculation of MSY. That is, the allowable fishery yields at the biological reference points defined in the FMP are *in addition to* assumed mortality due to natural causes, including mortality due to predation.

6.3.1.2 Alternative 3 for *Loligo* (most restrictive alternative)

The specifications under this alternative would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 13,000 mt and JVP and TALFF = 0 mt. These specifications are consistent with recommendations of SARC-29 which considered the Loligo stock to be below the spawning stock threshold or ½ Bmsy. This represents the most restrictive alternative considered by the Council.

In determining the specification of ABC for the year 2000, the Council considered the recommendations of SAW-29. Based on these analyses, the Council would have chosen to specify ABC as the yield associated with 75 percent of $F_{MSY,}$ or 11,700 mt based on the stock size as estimated in SAW-29. However, recent stock assessment data indicate that the *Loligo* stock has increased in size and is currently at or near B_{msy}. As a result, specifying ABC at 11,700 in 2002 would cause unnecessary reductions in yield and loss of revenue to the fishery. However since the stock is protected from overfishing by specifying the annual quota at level lower than 75% of F_{msy} under this alternative, it can be concluded that this level of ABC would not have any negative biological impacts on the *Loligo* stock or non-target species.

6.3.1.3 Alternative 3 for *Illex* (most restrictive alternative)

The specifications under this alternative would be Max OY =24,000 mt, ABC, IOY, DAH, and DAP = 19,000 mt and JVP and TALFF = 0 mt. This represents the most restrictive alternative considered by the Council.

Under this option, the directed fishery for *Illex* would remain open until 95% of ABC is taken (18,050 mt). When 95% of ABC is taken, the directed fishery will be closed and a 5,000 pound trip limit will remain in effect for the remainder of the fishing year. As noted above, in SAW 29 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. Based on the analyses presented in SAW 29, it can be concluded that this level ABC, which is less than the yield at F_{msy}, will not have any negative biological consequences for the *Illex* stock or non-target species.

6.3.1.4 Alternative 3 for butterfish

The specifications under this alternative would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 7,200 mt and JVP and TALFF = 0 mt. The Council rejected this option based on the advice given in the most recent assessment. Since this level of landings would not take discards of butterfish into account, this option could have a negative biological impact on the butterfish stock (based on the findings of the most recent assessment).

6.3.2 Socioeconomic Impacts

6.3.2.1 Alternative 3 for Atlantic mackerel (most restrictive)

The third alternative action considered by the Council for Atlantic mackerel in 2003 was to specify ABC at long term potential catch. The most recent estimate of LTPC was 134,000 mt. Therefore, the specifications under this alternative would be ABC=134,000 mt, IOY=85,000 mt, DAH=85,000 mt, DAP=50,000 mt and JVP=20,000 and TALFF=0 mt.

The use of LTPC as an upper bound on ABC was found to be inappropriate because it would not allow for variations and contingencies in the status of the stock. For example, the current adult stock was recently estimated to exceed 2.1 million mt. The specification of ABC at LTPC would effectively result in an exploitation rate of only about 6%, well below the optimal level of exploitation. The potential level of foregone yield under this alternative was considered unacceptable. The potential level of foregone yield under this alternative in 2004 could have negative economic and social consequences for the US mackerel industry. Table 4 lists the ports which landed Atlantic mackerel in 2002. The vessel owners, crews, dealers, processors and fishing communities associated with these ports would be expected to be affected the most by this alternative to the 2004 annual specifications for Atlantic mackerel.

6.3.2.2 Alternative 3 for *Loligo* (most restrictive alternative)

The specifications under this alternative would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 13,000 mt and JVP and TALFF = 0 mt. These specifications are consistent with recommendations of SARC-26 which considered the *Loligo* stock to be below the spawning stock threshold or ½ Bmsy. This represents the most restrictive alternative considered by the Council.

Specifying ABC at 11,700 in 2004 would cause unnecessary reductions in yield and loss of revenue to the fishery. Under this alternative, the quotas would be specified at levels lower than those specified by the overfishing definition control rule specified in the FMP. While the stock is protected from overfishing, some negative economic and social impacts could be expected from this alternative. Table20 lists the ports which landed *Loligo* in 2002. The vessel owners, crews, dealers, processors and fishing communities associated with these ports would be expected to be affected the most by this alternative to the 2004 annual specifications for *Loligo*.

6.3.2.3 Alternative 3 for *Illex* (most restrictive alternative)

The specifications under this alternative would be Max OY =24,000 mt, ABC, IOY, DAH, and DAP = 19,000 mt and JVP and TALFF = 0 mt. This represents the most restrictive alternative considered by the Council.

Under this option, the directed fishery for *Illex* would remain open until 95% of ABC is taken (18,050 mt). When 95% of ABC is taken, the directed fishery will be closed and a 5,000 pound trip limit will remain in effect for the remainder of the fishing year. Specifying ABC at 19,000 in 2004 for *Illex* would cause unnecessary reductions in yield and loss of revenue to the fishery. Under this alternative, the quotas would be specified at levels lower than those specified by the overfishing definition control rule specified in the FMP. While the stock is protected from overfishing, some negative economic and social impacts could be expected from this alternative. Table 26 lists the ports which landed *Illex* in 2002. The vessel owners, crews, dealers, processors and fishing communities associated with these ports would be expected to be affected the most by this alternative to the 2004 annual specifications for *Illex*.

6.3.2.4 Alternative 3 for butterfish

The specifications under this alternative would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 7,200 mt and JVP and TALFF = 0 mt. This represents the most restrictive alternative considered by the Council.

This action would not follow the advice of the most recent stock assessment and could result in negative biological consequences for the stock. Since the stock is not protected from overfishing, some negative economic and social impacts could be expected from these quota specifications for butterfish in 2004. Table 34 lists the ports which landed butterfish in 2002. The vessel owners, crews, dealers, processors and fishing communities associated with these ports would be expected to be affected the most by this alternative to the 2004 annual specifications for butterfish.

6.3.3 EFH Impacts

6.3.3.1 Alternative 3 for Atlantic mackerel (most restrictive)

The third alternative action considered by the Council for Atlantic mackerel in 2004 was to specify ABC at long term potential catch. The most recent estimate of LTPC was 134,000 mt. Therefore, the specifications under this alternative would be ABC=134,000 mt, IOY=85,000 mt, DAH=85,000 mt, DAP=50,000 mt and JVP=20,000 and TALFF=0 mt.

As noted in Table 3, Atlantic mackerel are taken primarily with mid-water otter trawls. This gear is not expected to adversely impact essential fish habitat since it is not in contact with the seabed. In addition, since this ABC specification is lower than the 2003 status quo specification of ABC, it should not result in an increase in fishing effort or redistribute effort by gear type. As a result, this alternative for Atlantic mackerel is not expected to negatively impact essential fish habitat.

6.3.3.2 Alternative 3 for *Loligo* (most restrictive alternative)

The specifications under this alternative would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 13,000 mt and JVP and TALFF = 0 mt. These specifications are consistent with recommendations of SARC-26 which considered the Loligo stock to be below the spawning stock threshold or ½ Bmsy. This represents the most restrictive alternative considered by the Council.

Otter trawls are the principal gear used in this fishery. In general, bottom tending mobile gear have the potential to reduce habitat complexity and change benthic communities. Available research indicates that the effects of mobile gear are cumulative and are a function of the frequency and intensity with which an area is fished, the complexity of the benthic habitat (structure), energy of the environment (high energy and variable or low energy and stable), and ecology of the community (long-lived versus short lived). The extent of an adverse impact on habitat requires high resolution data on the location of fishing effort by gear and the location of specific seafloor habitats. While the otter trawls utilized in this fishery have the potential to adversely affect EFH, available effort data are currently insufficient to predict the extent of adverse impact from this fishery. However, since this ABC specification is lower than the 2003 status quo specification of ABC for *Loligo*, it should not result in an increase in fishing effort or redistribute effort by gear type. Therefore, this alternative is not expected to increase any existing impacts on EFH caused by this fishery.

6.3.3.3 Alternative 3 for *Illex* (most restrictive alternative)

The specifications under this alternative would be Max OY =24,000 mt, ABC, IOY, DAH, and DAP = 19,000 mt and JVP and TALFF = 0 mt. This represents the most restrictive alternative considered by the Council.

Otter trawls are the principal gear used in this fishery. In general, bottom tending mobile gear have the potential to reduce habitat complexity and change benthic communities. Available research indicates that the effects of mobile gear are cumulative and are a function of the frequency and intensity with which an area is fished, the complexity of the benthic habitat (structure), energy of the environment (high energy and variable or low energy and stable), and ecology of the community (long-lived versus short lived). The extent of an adverse impact on habitat requires high resolution data on the location of fishing effort by gear and the location of specific seafloor habitats. While the otter trawls utilized in this fishery have the potential to adversely affect EFH, available effort data are currently insufficient to predict the extent of adverse impact from this fishery. However, since this ABC specification is lower than the 2003 status quo specification of ABC for *Illex*, it should not result in an increase in fishing effort or redistribute effort by gear type. Therefore, this alternative is not expected to increase any existing impacts on EFH caused by this fishery.

6.3.3.4 Alternative 3 for butterfish

The specifications under this alternative would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 7,200 mt and JVP and TALFF = 0 mt.

Otter trawls are the principal gear used in this fishery. In general, bottom tending mobile gear have the potential to reduce habitat complexity and change benthic communities. Available research indicates that the effects of mobile gear are cumulative and are a function of the frequency and intensity with which an area is fished, the complexity of the benthic habitat (structure), energy of the environment (high energy and variable or low energy and stable), and ecology of the community (long-lived versus short lived). The extent of an adverse impact on habitat requires high resolution data on the location of fishing effort by gear and the location of specific seafloor habitats. While the otter trawls utilized in this fishery have the potential to adversely affect EFH, available effort data are currently insufficient to predict the extent of adverse impact from this fishery. However, since this ABC specification is higher than the 2003 status quo specification of ABC for butterfish, it could result in an increase in fishing effort or redistribute effort by gear type. Therefore, this alternative could increase any existing impacts on EFH caused by this fishery.

6.3.4 Protected Resources Impacts

6.3.4.1 Alternative 3 for Atlantic mackerel

The third alternative action considered by the Council for Atlantic mackerel in 2004 was to specify ABC at long term potential catch. The most recent estimate of LTPC was 134,000 mt. Therefore, the specifications under this alternative would be ABC=134,000 mt, IOY=85,000 mt, DAH=85,000 mt, DAP=50,000 mt and JVP=20,000 and TALFF=0 mt.

Since the ABC specification is lower than the 2003 ABC specification, it is not expected to increase fishing effort or redistribute effort by gear type. As such, the implementation of this alternative is not expected to impact protected species described in section 4.3 relative to 2003 specifications for Atlantic mackerel.

6.3.4.2 Alternative 3 for *Loligo* (most restrictive alternative)

The specifications under this alternative would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 13,000 mt and JVP and TALFF = 0 mt. These specifications are consistent with recommendations of SARC-26 which considered the *Loligo* stock to be below the spawning stock threshold or ½ Bmsy. This represents the most restrictive alternative considered by the Council.

Under this alternative, the quota would be specified at level that is 4,000 mt lower than is specified by the overfishing definition control rule in the FMP . As a result, this alternative would likely result in a decrease in fishing effort in the *Loligo* fishery compared to the 2003 specification. As such, the implementation of this alternative is not expected to impact protected species described in section 6.4.3 relative to 2003 specifications for *Loligo*. Moreover, since fishing effort is likely to be lower under this alternative, the probability of interactions with common dolphin in the *Loligo* fishery would be expected to be reduced accordingly.

6.3.4.3 Alternative 3 for *Illex* (most restrictive alternative)

The specifications under this alternative would be Max OY =24,000 mt, ABC, IOY, DAH, and DAP = 19,000 mt and JVP and TALFF = 0 mt. This represents the most restrictive alternative considered by the Council.

Under this alternative, the quota would be specified at level that is 3,000 mt lower than is specified by the overfishing definition control rule in the FMP . As a result, this alternative would likely result in a decrease in fishing effort in the *lllex* fishery compared to the 2003 specification. As such, the implementation of this alternative is not expected to impact protected species described in section 6.4.3 relative to 2003 specifications for *lllex*. Moreover, since fishing effort is likely to be lower under this alternative, the probability of interactions with pilot whales in the *Illex* fishery would be expected to be reduced accordingly.

6.3.4.4 Alternative 3 for butterfish

The specifications under this alternative would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 7,200 mt and JVP and TALFF = 0 mt.

Under this alternative, the quota would be specified at level that is higher than was specified in 2003 based on management advice from the most recent assessment. As a result, this alternative could result in an increase fishing effort. Therefore, the implementation of this alternative could have a greater impact on the protected species described in section 6.4.3 relative to 2003 specifications for butterfish.

6.4 Research Set-Asides (RSA)

6.4.1 2004 RSA Recommendations

Framework Adjustment 1 to the Atlantic Mackerel, Squid and Butterfish FMP established a program in which data collection projects can be funded in part through a percentage research set-aside (RSA) from total annual quota for each species. The purpose of this program is to support research and the collection of additional data that would otherwise be unavailable. Through the set aside program, the Council encourages collaborative efforts between the public, research institutions, and government in broadening the scientific base upon which management decisions are made. Reserving a small portion of the annual harvest of a species to subsidize the research costs of vessel operations and scientific expertise is considered an important investment in the future of the nation's fisheries.

An additional benefit that is sought from this program is the assurance that new data collected by non-governmental entities will receive the peer review and analysis necessary to be utilized in improving the management of public fisheries resources. The annual research set-aside amount may vary between 0 and 3% of each species' quota. For those species that have both a commercial quota and a recreational harvest limit, the set-aside calculation shall be made from the combined total allowable landing level.

The Council recommended that, if research projects are approved by December 31, 2003, up to 3% of ABC, IOY, DAH and DAP for 2004 may be set-aside for *Loligo* and *Illex* squid and up to 2% of IOY may be set-aside for scientific research for Atlantic mackerel and butterfish. Under the preferred alternative for each species, the following amounts would be set-aside for scientific research: *Loligo*- 510 mt, *Illex*- 720 mt, Atlantic mackerel - 3,400 mt, and butterfish - 118 mt (see Table RSA-1 below).

Table RSA-1. Proposed Research Quota Set-asides, in mt, for Atlantic Mackerel, Squid, and Butterfish for the Fishing Year January 1 through December 31, 2003.

Specifications	*Loligo*	*Illex*	Mackerel	Butterfish
Research Set-aside	510	720	3,400	118
Remaining Quota	16,490	23,280	166,600	5,782
Total	17,000	24,000	170,000	5,900

A number of research projects have been submitted to NMFS that would require an exemption from some of the current or proposed regulations for these species. The following analysis was prepared in response to the need for an analyses of the impacts of the research set-asides on the human environment pursuant to NEPA. This analysis also serves to help expedite the approval and implementation of these proposed research projects. Should the proposed research projects be approved, researchers could be permitted to fish for *Loligo* squid in the scup gear restricted areas (GRAs) and allowed to retain landings of *Loligo* squid in amounts greater than 2,500 pounds during a closure of the directed *Loligo* squid fishery.

6.4.2 Environmental Consequences of the RSA Amounts

6.4.2.1 Biological Impacts

As noted in the above table, the amount of research quota set-aside relative to the overall annual quotas for Atlantic mackerel, squid, and butterfish is minimal. Therefore, given the limited scope and duration of the proposed research projects, it is unlikely that exemptions from the scup gear restricted areas (GRAs) or the retention of *Loligo* squid landings in amounts greater than 2,500 pounds during a closure of the directed *Loligo* squid fishery would have negative biological impacts since fishing mortality on the *Loligo* stock is controlled by the overall quota (which includes the RSA amounts specified). A more detailed description of each of the proposed exemptions is given below and additional descriptions of the stocks and their habitats can be found under sections 4.0 and 5.0 above.

In an attempt to reduce scup bycatch and unwanted discards, regulations implementing scup GRAs were implemented in beginning in 2000. Under these regulations, vessels fishing for non-exempt species, including *Loligo* squid, are required to fish using the scup minimum mesh size of 4 ½ in. Given the need to use small mesh sizes to retain *Loligo* squid (1 7/8 in. minimum mesh size), the *Loligo* squid fishery inside the scup GRAs was essentially eliminated. Several researchers have proposed projects that would test gear modifications in an attempt to allow unwanted scup bycatch to escape while retaining *Loligo* squid catches. To evaluate these gear modifications, researches have requested exemptions that would permit fishing for *Loligo* squid in the scup GRAs using mesh sizes less than 4 ½ in.

The harvesting of *Loligo* squid in the scup GRAs is not expected to have negative biological impacts on the *Loligo* squid fishery. As mentioned above, the amount of *Loligo* squid set-aside is minimal and is included in the overall *Loligo* squid quota. Therefore, the 3 percent set-aside, whether harvested through research projects or through the normal prosecution of the *Loligo* squid fishery, would have occurred. Further biological impacts from this exemption are related to the retention and discard of scup taken in the small mesh squid gear used in these experiments. These impacts will be evaluated in the Environmental Assessment for the 2004 annual scup specifications.

The annual *Loligo* squid quota is divided into quarterly quota periods (Table RSA-2). Current regulations specify that after the quarterly quota is attained the directed *Loligo* squid fishery is closed and only an incidental catch amount of 2,500 lb per calendar day may be retained. Some of the proposed research projects have requested an exemption from the 2,500 lb limit. This would allow research vessels to land *Loligo* squid in amounts greater than 2,500 lb per calender day during a quarterly closure of the directed *Loligo* squid fishery.

Table RSA-2. Proposed *Loligo* Squid Quarterly Allocations.

Quarter		Percent	Metric Tons	Research Set-aside
I	(Jan-Mar)	33.23	5,479	N/A
II	(Apr-Jun)	17.61	2,904	N/A
III	(Jul-Sep)	17.30	2,853	N/A
IV	(Oct-Dec)	31.86	5,254	N/A
Total		100	16,490	102

The annual quota established for *Loligo* squid is the chief mechanism used to control fishing mortality. The research set-aside quota is deducted from the annual quota prior to the allocation of the quota into quarters. The proposed total allowable landings for the 2003 *Loligo* squid fishery is 17,000 mt, 3 percent (510 mt) of which may be used as research set-aside. The 3 percent set-aside is deducted from the overall *Loligo* squid quota prior to dividing the quota into quarterly allocations. Research quota harvested after a quarterly closure of the directed fishery will not count towards that quarter's quota, but instead will count towards the overall *Loligo* squid quota for the entire year. This will prevent total quota overages, and thus possible negative biological impacts from occurring as the result of research quota harvested after the directed fishery has closed. As noted in the proposed scup GRA exemption, the amount of *Loligo* squid set-aside is minimal and the 3 percent set-aside, whether harvested through research projects or through the normal prosecution of the *Loligo* squid fishery, would have occurred. Therefore, the harvesting of *Loligo* squid after a closure of the directed fishery is not expected to have negative biological impacts on the *Loligo* squid fishery.

6.4.2.2 Economic and Social Impacts

Under this program, successful applicants receive a share of the annual quota for the purpose of conducting scientific research. The Nation receives a benefit in that data or other information about that fishery is obtained for management or stock assessment purposes that would not otherwise be obtained. In fisheries where the entire quota would be taken and the fishery is prematurely closed (i.e., the quota is constraining), the economic and social costs of the program are shared among the non-RSA participants in the fishery. That is, each participant in a fishery that utilizes a resource that is limited by the annual quota relinquishes a share of the amount of quota retained in the RSA quota.

In 2003, the only fishery where this case applied was in the *Loligo* fishery. Assuming the same number of vessels participate in the 2004 *Loligo* fishery as in 2003, the cost of the RSA for

Loligo would be shared among a maximum of 425 vessels (this assumes that only one vessel is awarded the entire RSA amount). In this example, the average non-RSA vessel would forego 0.25 mt of *Loligo* to the RSA quota category (valued at $355). The total revenue amount foregone to the RSA quota category would be valued at $155,000. No economic effect of the RSA amount is anticipated in 2004 for *Illex,* Atlantic mackerel, or butterfish since the quotas did not constrain those fisheries in 2003.

As discussed above, researchers have requested exemptions from the minimum mesh restrictions in the scup GRAs and for the retention of *Loligo* squid landings in amounts greater than 2,500 pounds during a closure of the directed *Loligo* squid fishery. Because the amount of set-aside quota is limited, these exemptions are expected to have only minimal economic and social impacts. A detailed description of the fishing activities, economic environment, and participants in these fisheries can be found under section 5.0.

Under the research quota set-aside program, vessels that do not possess a limited access *Loligo* squid permit may participate in research projects. Therefore, it is possible that research participants, outside the scope of vessels possessing limited access *Loligo* squid permits, may harvest *Loligo* squid in amounts greater than is currently permitted under the open access incidental catch *Loligo* squid permit (2,500 lb per calender day). This could have an economic impact on limited access *Loligo* squid permit holders because it is possible that a small portion of the annual quota may be redistributed to vessels that might not ordinarily participate in this fishery. However, because the research set-aside quota is of a limited amount, the overall economic impacts to limited access permitted vessel owners and their crews will be minimal. No negative economic or social impacts for dealers or processors under this scenario are expected.

Because some vessels may be harvesting *Loligo* squid in amounts greater than 2,500 lb per calender day during a quarterly closure of the directed *Loligo* squid fishery, vessels could receive higher prices for their catch than would ordinarily occur during the regular opening of the fishery. This could provide positive economic impacts for the vessel owners and crews participating in research projects. Also, dealers and processors intent on maintaining a steady inventory of fresh *Loligo* squid may benefit.

6.4.2.3 EFH Impacts

The recommended RSA levels are given in Table RSA-1. Through the use of the research quota set-aside, the basic fishing operations for Atlantic mackerel, squid, and butterfish are expected to remain the same. In addition, the RSA specifications should not result in an increase in fishing effort or redistribute effort by gear type. Therefore, the overall impact to essential fish habitat is not expected to change. It should be noted, however, that fishing activities under the RSA program may occur in areas and or times outside those of the normal directed fisheries. The degree of the resulting impacts to EFH of these RSA fishing activities, if any, are not precisely known but are believed to be minimal.

6.4.2.4 Endangered Species and 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). Through the use of the research quota set-aside, the basic fishing operations for Atlantic mackerel, squid, and butterfish are expected to remain the same. It should be noted, however, that fishing activities under the RSA program may occur in areas and/or times outside those of the normal directed fisheries. The degree of the resulting impacts on protected resources of these RSA fishing activities, if any, are not precisely known but are believed to be minimal. Therefore, the overall impact to species afforded protection under the ESA and the MMPA are not expected to change. A complete description of these species and a discussion of the potential impacts the Atlantic mackerel, squid, and butterfish fisheries may have on them can be found in section 4.3.

6.4.3 Summary of Impacts

The biological, economic and social impacts of the proposed specifications (preferred alternatives)for 2004 action are expected to be minimal since they maintain the status quo in each fishery. The proposed specifications are considered the most reasonable to achieve the fishery conservation objectives while minimizing the impacts on fishing communities as per the objectives of the FMP. A summary of the environmental consequences for each of the alternatives considered is given in the Table ES-1 (see Executive summary).

6.5 Cumulative Impacts of Preferred Alternatives

A cumulative impact analysis is required by the Council on Environmental Quality's (CEQ) regulation for implementation of NEPA. Cumulative effects are defined under NEPA as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other action (40 CFR section 1508.7)." A formal cumulative impact assessment is not necessarily required as part of an Environmental Assessment under NEPA as long as the significance of cumulative impacts has been considered (U.S. EPA 1999). The following remarks address the significance of the expected cumulative impacts as they relate to the Federally managed Atlantic mackerel, squid and butterfish fisheries.

The cumulative impacts of past, present, and future Federal fishery management actions (including the specification recommendations proposed in this document) should generally be positive. Although past fishery management actions to conserve and protect fisheries resources and habitats may have been more timely in the past, the mandates of the MSFCMA, as currently amended by the SFA, and the NEPA require the management actions be taken only after consideration of impacts to the biological, physical, economic, and social dimensions of the human environment. It is, therefore, expected that under the current management regime, the long term cumulative impacts of federal fishery management actions under this FMP and annual specifications process, in general, contribute toward improving the human environment.

In addition to the direct effects on environment from fishing, the cumulative effects to the physical and biological dimensions of the environment may also come from non-fishing activities. Non-fishing activities, in this sense, relate to habitat loss from human interaction and alteration or natural disturbances. These activities are widespread and can have localized impacts to habitat such as accretion of sediments from at-sea disposal areas, oil and mineral resource exploration, and significant storm events. In addition to guidelines mandated by the MSFMCA, NMFS reviews these types of effects during the review process required by Section 404 of the Clean water Act and Section 10 of the Rivers and Harbors Act for certain activities that are regulated by Federal, state, and local authority. The jurisdiction of these activities is in "waters of the United States" and includes both riverine and marine habitats. A database which could facilitate documentation regarding cumulative impacts of non-fishing activities on the physical and biological habitat in the management unit covered by this FMP is not available at this time. The development of a habitat and effect database would expedite the review process and outline areas of increased disturbance. Inter-agency coordination would also prove beneficial.

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 and butterfish, the domestic fisheries have been fully developed. All three species are considered to be fully utilized by the US domestic fishery and none are considered to be overfished as a result of the management plan developed by the Council. For Atlantic mackerel, the full development of the domestic fishery is still ongoing. The Atlantic mackerel stock is currently considered to be in good condition and is designated as under-exploited. While it appears that this stock is capable of supporting increased levels of exploitation by the US domestic fishery, the Council is currently considering the development of a controlled access plan to control expansion of harvest capacity and avoid over-capitalization in the Atlantic mackerel fishery.

The cumulative impacts of this FMP were last fully addressed in the EIS for Amendment 8 and are currently being re-addressed in the draft Amendment 9 which is under development. All four species in the management unit are managed primarily via annual quotas to control fishing mortality. This FMP requires a specifications process which allows for the review and modifications to management measures specified in the FMP on an annual basis which allows for review. In addition, 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 noted above, the cumulative impact of this FMP and annual specification process has been positive since its implementation after passage of the Magnuson Act.

Through development of the FMP and the subsequent annual specification process, the Council continues to manage these resources in accordance with the National Standards required under the Magnuson-Stevens Act. First and foremost the Council has met the obligations of National Standard 1 by adopting and implementing conservation and management measures that have prevented overfishing, while achieving, on a continuing basis, the optimum yield for the four species and the United States fishing industry. The Council uses the best scientific information available (National Standard 2) and manages these two resources throughout their range (National Standard 3). The management measures do not discriminate between residents of different states (National Standard 4), they do not have economic allocation as its sole purpose (National Standard 5), the measures account for variations in fisheries (National Standard 6), avoid unnecessary duplication (National Standard 7), they take into account the fishing communities (National Standard 8), address bycatch in these fisheries (National Standard 9) and promote safety at sea (National Standard 10). By continuing to meet the National Standards requirements of the Magnuson-Stevens Act through future FMP amendments and actions, the Council will insure that cumulative impacts of these actions will remain overwhelmingly positive for the ports and communities that depend on these fisheries, the Nation as a whole.

The cumulative effects of the proposed quotas will be examined for the following five areas: targeted species, non-targeted species, protected species, habitat, and communities.

Targeted species

First and foremost, the Council has met the obligations of National Standard 1 by adopting and implementing conservation and management measures that have prevented overfishing, while achieving, on a continuing basis, the optimum yield for the four species and the United States fishing industry. Atlantic mackerel were overfished prior to management and then were subsequently rebuilt under the FMP and it's amendments. *Loligo* were considered overfished in 2000 but remedial action by the Council in subsequent years (i.e., reduced quotas) resulted in stock rebuilding t the point that the species in no longer consider overfished. *Illex* and butterfish have never been designated as overfished.

The most obvious and immediate impact on the stocks managed under this FMP results from the mortality that occurs from fishing activities. The Council manages Federally permitted vessels which fish for these four species throughout their range in both Federal and state waters. Fishing mortality from all fishing activities that land these species is controlled and accounted for by the quotas described in section 3.0. In addition to fishing mortality related landings, there are other fishing activities that take these species as bycatch that impact these populations because they represent additional sources of mortality (i.e., due to discarding). However, estimates of bycatch related mortality in non-directed fisheries are incorporated into the stock assessment for each species. Therefore, mortality from non-directed sources is explicitly accounted for in stock assessment models which form the basis for establishing the proposed quotas. In addition to mortality on these stocks due to fishing, there are other indirect effects on these stocks from non-fishing anthropogenic activities in the Atlantic Ocean, but these are generally not quantifiable at present. None the less, since these species occur over wide areas of the mid and north Atlantic Ocean and inhabit both inshore and offshore pelagic waters, it is unlikely that any indirect anthropogenic activity currently significantly impact these populations, especially in comparison to the direct effects on these populations as a result of fishing.

In summary, a major goal of this FMP has been the Americanization of these fisheries. Prior to the passage of the Magnuson Act and development of this FMP, the foreign prosecution of these fisheries occurred at much higher levels of fishing effort, which in many cases, resulted in overfishing . The first phase of the domestic fishery development was the elimination of these foreign fisheries and the transfer of the offshore fishing technology to the US fishing fleet. Thus, the immediate and cumulative impact was to end overfishing of these stocks, most notably in the case of Atlantic mackerel. In addition, the foreign fishery landings for the other three species in the management unit also reached unsustainable levels prior to FMP development and implementation. The second phase of FMP implementation was the controlled development of these fisheries which allowed stock rebuilding, especially in the case of Atlantic mackerel. The final phase of FMP implementation has been to adopt and implement new overfishing defintions which are consistent with the SFA. The end result has been, at least in the case of *Loligo* and *Illex,* that harvest capacity and quotas have been matched to provide for long term, sustainable utilization of these resources. The quotas proposed under the preferred alternatives for 2004 maintain this process.

Non-target species or bycatch

National Standard 9 addresses bycatch in fisheries. 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.

None of the management measures proposed by the Council for 2004 under the preferred alternatives will promote or result in increased levels of bycatch relative to the no action, since the specifications proposed under preferred alternatives are either equal to or less than the 2003 status quo. A few of the options considered in section 3.0 by the Council, if implemented, would have resulted in an increase in the quota relative to the 2003 status quo. In those cases, it is possible that effort would increase under those options, but most likely this would only occur under the least restrictive option for *Loligo* squid. In that case, it is possible that effort could increase in the directed *Loligo* fishery relative to the 2003 status quo and bycatch of non-target species could increase accordingly. Based on unpublished NMFS sea sampling data for 1997-2001, the non-targeted species of concern (i.e, taken incidental to the *Loligo* fishery) include butterfish, scup, red hake, spiny dogfish, and common dolphin. It is not currently possible to determine if the potential impact on non-target species due to this increase in fishing effort would be significant.

Protected resources

There are numerous species which inhabit the environment within the management unit of this FMP that are afforded protection under the Endangered Species Act (ESA) of 1973 (i.e., for those designated as threatened or endangered) and/or the Marine Mammal Protection Act of 1972 (MMPA). Eleven are classified as endangered or threatened under the ESA, while the remainder are protected by the provisions of the MMPA. The species protected either by the Endangered Species Act of 1973 (ESA), the Marine Mammal Protection Act of 1972 (MMPA), or the Migratory Bird Act of 1918, that be found in the environment utilized by Atlantic mackerel, squid and butterfish fisheries are listed in section 4.3.

As noted above, none of the management measures proposed for 2004 under the preferred alternatives will promote or result in increased levels of bycatch relative to the no action, since the specifications proposed under the preferred alternatives are either equal to or less than the 2003 status quo. A few of the options considered in section 3.0 by the Council, if implemented, could have result in an increase in the quota relative to the 2003 status quo. In those cases, it is possible that effort would increase under those options, but in most cases it would be unlikely because landings have been far below status quo specifications in the case of *Illex*, mackerel and butterfish. The only option considered that could result in an increase in fishing effort would be the least restrictive option for *Loligo* squid. In that case, it is possible that effort could increase in the directed *Loligo* fishery relative to the 2003 status quo and bycatch of non-target species, including those protected resources described could increase accordingly. Common dolphins are the protected species of primary concern in the *Loligo* fishery. However ,it is not currently possible to determine if the potential impact on common dolphins due to this increase in fishing effort would be significant.

As noted above, a major goal of this FMP has been the Americanization of these fisheries. Prior to the passage of the Magnuson Act and development of this FMP, the foreign prosecution of these fisheries occurred at much higher levels of fishing effort. As described in section 4.3, the foreign fisheries for Atlantic mackerel, squid and butterfish were a major source of mortality for a number of marine mammal stocks. The elimination of these fisheries and subsequent controlled development of the domestic fisheries for Atlantic mackerel, squid and butterfish have resulted in fishing effort levels much lower than those which occurred in the foreign fisheries prior to FMP development and implementation. The cumulative effect of the maintenance of these fishing effort levels under the current management program, in conjunction with future take reduction plan efforts under the MMPA, should be to minimize the impact of these fisheries on marine mammal stocks.

Habitat

The 2002 final rule for EFH requires that fishery management plans minimize to the extent practicable adverse effects on essential fish habitat caused by fishing (section 600.815 (a) (2)). Pursuant to the final EFH regulations (50 CFR 600.815(a)(2)), FMPs must contain an evaluation of the potential adverse effects of fishing on EFH designated under the FMP, including effects of each fishing activity regulated under the FMP or other Federal FMPs. The evaluation should consider the effects of each fishing activity on each type of habitat found within EFH. FMPs must describe each fishing activity, review and discuss all available relevant information (such as information regarding the intensity, extent, and frequency of any adverse effect on EFH: the type of habitat within EFH that may be affected adversely; and the habitat functions that may be disturbed), and provide conclusions regarding whether and how each fishing activity adversely affects EFH. The evaluation should also consider the cumulative effects of multiple fishing activities on EFH

The Council made the last determination about gear impacts on EFH in Amendment 8 (see section 7.0 below). The Council concluded in Amendment 8 that the measures implemented through the Atlantic Mackerel, Squid and Butterfish FMP, minimize the adverse effects of fishing on EFH, to the extent practicable, pursuant to Section 303(a)(7) of the MSA. The proposed quotas under the preferred alternatives in this action maintain the status quo, and therefore, do not alter this conclusion relative to the cumulative effects on EFH since no change in fishing effort is anticipated as a result of these quota specifications. The Council is currently developing Amendment 9 to the Atlantic Mackerel, Squid and Butterfish FMP and is conducting additional analyses concerning gear impacts on EFH as part of that amendment.

Communities

National Standard 8 requires that management measures take into account the fishing communities. The Council hired Dr Bonnie McCay and her associates from Rutgers University to describe the ports and communities that are associated with the Atlantic Mackerel, Squid and Butterfish fisheries. Communities from Maine to Virginia are involved in the harvesting of Atlantic mackerel, squid and butterfish and are described in more detail in Appendix 1 and sections 4 and 5.

With regard to the quota recommendations under the preferred alternatives that are proposed in this document, the impacts expected to the affected biological and physical and human environment are described in section 6. Given that no negative impacts are anticipated to result from the preferred alternatives, the synergistic interaction of improvements in the efficiency of the fishery are expected to generate positive impacts overall. These impacts will be felt most strongly in the social and economic dimension of the environment. Direct economic and social benefit from improved fishery efficiency is most likely to affect participants in these fisheries. These benefits are addressed in the RIR/IRFA of this document. Indirect benefits of the preferred alternatives are likely to affect consumers and in areas of the economic and social environment that interact in various ways with these fisheries.

The proposed actions, together with past and future actions are expected to result in positive cumulative impacts on the biological, physical, and human components of the environment. These fisheries have been well managed since implementation of the FMP in the early 1980s. Both the resources and the fisheries they support appear to be in good condition. As long as management continues to prevent overfishing, the fisheries and their associated communities should continue to prosper.

7.0 Essential Fish Habitat Assessment

Atlantic mackerel, squid and butterfish have EFH designated in many of the same bottom habitats that have been designated as EFH for most of the groundfish within the Northeast Multispecies FMP, including: Atlantic cod, haddock, monkfish, ocean pout, American plaice, pollock, redfish, white hake, windowpane flounder, winter flounder, witch flounder, yellowtail flounder, Atlantic halibut and Atlantic sea scallops. Broadly, EFH is designated as the bottom habitats consisting of varying substrates (depending upon species) within the Gulf of Maine, Georges Bank, and the continental shelf off southern New England and the mid-Atlantic south to Cape Hatteras for the juveniles and adults of these groundfish. In general, these areas are the same as those designated for Atlantic mackerel, squid and butterfish.

Fishing activities for Atlantic mackerel, squid and butterfish occur in these EFH areas. The primary gear utilized to harvest these species is the otter trawl. Since the otter trawl is a bottom-tending mobile gear, it is most likely to be associated with adverse impacts to bottom habitat. The primary impact associated with this type of gear is reduction of habitat complexity (Auster and Langton, 1998).

Amendment 8 included overfishing definitions which are the same or more conservative than overfishing definitions from previous Amendments. As a result, the quota specifications resulting from these new overfishing definitions are the same or lower than in previous years. This should effectively result in the same or reduced gear impacts to bottom habitats by reducing or maintaining the harvest of the managed species within this FMP. Any reductions in harvesting effort may indirectly benefit EFH by creating an overall reduction of disturbance by a gear type that impacts bottom habitats. Other management actions already in place should control redirection of effort into other bottom habitats (including, but not limited to stock rebuilding programs for other species that are designated as overfished, limited access programs to control entry of new fishing effort, and measures such as days-at sea limits, quotas, seasons and trip limits that tend to limit fishing effort in this and other managed fisheries throughout the Northwest Atlantic Ocean under US jurisdiction). Therefore, the Council has concluded that the 2004 quota specifications for Atlantic mackerel, squid and butterfish will have no more adverse impacts on EFH listed in Amendment 8. The Council concluded in Amendment 8 that the measures implemented by through the Atlantic mackerel, squid and butterfishFMP, minimize the adverse effects of fishing on EFH, to the extent practicable, pursuant to Section 303(a)(7) of the MSA. The proposed quotas under the preferred alternatives in this action maintain the status quo, and therefore, does not alter this conclusion relative to EFH. The Council is currently developing Amendment 9 to the Atlantic Mackerel, Squid and Butterfish FMP and is conducting additional analyses concerning gear impacts on EFH as part of that amendment.

8.0 Coastal Zone Management Act

The Council determined that this action is consistent to the maximum extent practicable with the enforceable provisions of the approved coastal management programs of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida. This determination was submitted for review by the responsible state agencies on August 26, 2003 under section 307 of the Coastal Zone Management Act.

9.0 List of Agencies and persons consulted in formulating the action

In preparing this annual specifications analysis the Council consulted with the NMFS, New England and South Atlantic Fishery Management Councils, Fish and Wildlife Service, Department of State, and the states of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina through their membership on the Council. In addition, states that are members within the management unit were be consulted through the Coastal Zone Management Program consistency process. Letters were sent to the states within the management unit reviewing the consistency of the proposed action relative to each state's Coastal Zone Management Program.

10.0 LIST OF PREPARERS

This environmental assessment was prepared by the following members of the MAFMC staff: Dr. Christopher M. Moore, Richard J. Seagraves, Dr. Jose L. Montanez, James Armstrong, and Kathy Collins.

11.0 Finding of no significant environmental impact

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 specifications for 2004 are expected to jeopardize the sustainability of any target species affected by the action. All of the proposed quota specifications under the preferred alternatives for each species are consistent with the FMP overfishing definitions. This action will protect the long-term sustainability of the Atlantic mackerel, *Illex* and *Loligo* squid, and butterfish stocks.

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 specifications 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 most recent Framework document. The preferred alternatives for the proposed 2004 specifications should not result in any increase in or redirection of effort. As a result, no new EFH Conservation Recommendations are necessary.

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 specifications continue the 2003 ABC specifications for each species for another fishing year. None of the specifications are expected to alter 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 proposed rule will have no adverse impacts on marine mammals. 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 maintain the 2003 status quo ABC specifications for an additional year. None of the measures alters fishing methods or activities. As such, the proposed measures are not expected to result in any cumulative effects on target or non-target species.

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 maintain the ABC specifications for an additional year. None of the specifications are expected to result in increased fishing effort. In addition, none of the measures are expected to alter fishing methods or activities. Therefore, none of the proposed actions are expected to jeopardize the sustainablility of non-target species.

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 6.0 of this EA, the proposed specifications for 2004 are 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.

9. To what degree are the effects on the quality of the human environment expected to be highly controversial?

The proposed measures maintain the status quo ABC specifications for each species for an additional year. Therefore, the measures contained in this action are not expected to be highly controversial.

FONSI Statement

Having reviewed the environmental assessment and the available information relating to the proposed 2004 annual specifications for Atlantic Mackerel, Squid and Butterfish, 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________________________________

OTHER APPLICABLE LAWS

1.0 PAPERWORK REDUCTION ACT OF 1995

The Paperwork Reduction Act (PRA) concerns the collection of information. The intent of the PRA is to minimize the Federal paperwork burden for individuals, small business, state and local governments, and other persons as well as to maximize the usefulness of information collected by the Federal government. There are no changes to the existing reporting requirements previously approved under this FMP for vessel permits), dealer reporting and 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 Atlantic mackerel squid and butterfish Federally-permitted dealers must submit weekly reports of fish purchases. In addition to detailed weekly reports of all purchases for all species from fishing vessels, dealers must also submit a weekly summary of their purchases via the Interactive Voice Response (IVR) system. The owner or operator of any vessel issued a vessel permit for Atlantic mackerel squid and butterfish 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. The owner of any party or charter boat issued an Atlantic mackerel party/charter permit and carrying passengers for hire shall maintain on board the vessel, and submit, an accurate daily fishing log report for each charter or party fishing trip that lands Atlantic mackerel, unless such a vessel is also issued another permit that requires regular reporting, in which case a fishing log report is required for each trip regardless of species retained. These reporting requirements are critical for monitoring the harvest level of these fisheries.

2.0 RELEVANT FEDERAL RULES

This action will not duplicate, overlap or conflict with any other Federal rules.

2.1 Executive Order 12898: Environmental Justice in Minority and Low-Income Populations and Indian Tribes

This Executive Order provides that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. " EO 12898 directs each Federal agency to analyze the environmental effects, including human health, economic, and social effects of Federal actions, including effects on minority populations, low-income populations, and Indian tribes, when such analysis is required by NEPA. Agencies are further directed to "identify potential effects and mitigation measures in consultation with affected communities, and improve the accessibility of meetings, crucial documents, and notices."

The proposed action under the preferred alternative maintains the status quo in terms of participation in the Atlantic mackerel, squid and butterfish fisheries. Since the proposed action represents no change relative to the current level of participation in these fisheries, no negative biological, economic or social effects are anticipated as a result (see section 6.0). Therefore, the proposed action under the preferred alternatives are not expected to cause disproportionately high and adverse human health, environmental or economic effects on minority populations, low-income populations, or Indian tribes.

2.2 SECTION 515 INFORMATION QUALITY DETERMINATION

Utility of Information Product

Explain how the information product meets the standards for utility: Is the information helpful, beneficial or serviceable to the intended user?

The proposed document includes a description of the 2004 Specifications and a description of the alternatives considered and the reasons for selecting the preferred management measures proposed. This proposed specifications document implements the FMP's conservation and management goals consistent with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as well as all other existing applicable laws.

Is the data or information product an improvement over previously available information? Is it more current or detailed? Is it more useful or accessible to the public? Has it been improved based on comments from or interactions with customers?

This proposed specifications document was developed as a result of a multi-stage process that involved review of the source document 2004 Specifications package by affected members of the public. The public had the opportunity to review and comment on management measures during the Atlantic Mackerel, Squid and Butterfish Monitoring Committee Meetings held on June 16, 2003 and during the Mid-Atlantic Fishery Management Council Meeting held on June 24-26, 2003 in Philadelphia, PA.

What media are used in the dissemination of the information? Printed publications? CD-ROM? Internet? Is the product made available in a standard data format? Does it use consistent attribute naming and unit conventions to ensure that the information is accessible to a broad range of users with a variety of operating systems and data needs?

The Federal Register notice that announces the proposed rule and the implementing regulations will be made available in printed publication and on the website for the Northeast Regional Office. The notice provides metric conversions for all measurements.

Integrity of Information Product

Explain how the information product meets the standards for integrity:

All electronic information disseminated by National Oceanic and Atmospheric Administration (NOAA) adheres to the standards set out in Appendix III, "Security of Automated Information Resources," OMB Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

If information is confidential, it is safeguarded pursuant to the Privacy Act and Titles 13, 15, and 22 of the U.S. Code (confidentiality of census, business and financial information).

Other/Discussion (e.g., Confidentiality of Statistics of the Magnuson-Stevens Fishery Conservation and Management Act; NOAA Administrative Order 216-100, Protection of Confidential Fisheries Statistics; 50 CFR 229.11, Confidentiality of information collected under the Marine Mammal Protection Act.)

Objectivity of Information Product

Indicate which of the following categories of information products apply for this product:

- *Original Data*
- *Synthesized Products*
- *Interpreted Products*
- *Hydrometeorological, Hazardous Chemical Spill, and Space Weather Warnings, Forecasts, and Advisories*
- *Experimental Products*
- *Natural Resource Plans*
- *Corporate and General Information*

Describe how this information product meets the applicable objectivity standards. (See the DQA Documentation and Pre-Dissemination Review Guidelines for assistance and attach the appropriate completed documentation to this form.)

What published standard(s) governs the creation of the Natural Resource Plan? Does the Plan adhere to the published standards? (See the NOAA Sec. 515 Information Quality Guidelines, Section II(F) for links to the published standards for the Plans disseminated by NOAA.)

In preparing the Specifications document, the responsible Regional Fishery Management Council (Council) must comply with the requirements of the Magnuson-Stevens Act, the Regulatory Flexibility Act, the Paperwork Reduction Act, the Coastal Zone Management Act, the Endangered Species Act, the Marine Mammal Protection Act, the Data Quality Act, and Executive Orders 12612 (Federalism), 12866 (Regulatory Planning), and other applicable laws.

Was the Plan developed using the best information available? Please explain.

This specification's document has been developed to comply with all applicable National Standards, including National Standard 2. National Standard 2 states that the FMP's conservation and management measures shall be based upon the best scientific information available. Despite current data limitations, the conservation and management measures proposed to be implemented under this specifications document are based upon the best scientific information available. This information includes NMFS dealer weighout data for 2002 which was used to characterize the economic impacts of the management proposals. These data, as well as the NMFS Observer program database, were used to characterize historic landings, species co-occurrence in the Atlantic Mackerel, squid and butterfish catch, and discarding. The specialists who worked with these data are familiar with the most recent analytical techniques and with the available data and information relevant to the Atlantic Mackerel, squid and butterfish fisheries. Marine Recreational Fisheries Statistics Survey data was used to characterize the recreational fishery for Atlantic mackerel.

Have clear distinctions been drawn between policy choices and the supporting science upon which they are based? Have all supporting materials, information, data and analyses used within the Plan been properly referenced to ensure transparency?

The policy choices (i.e., management measures) proposed to be implemented by this specifications document are supported by the available scientific information and, in cases where information was unavailable, proxy reference points are based on observed trends in survey data. The management measures contained in the specifications document are designed to meet the conservation goals and objectives of the FMP, and prevent overfishing and rebuild overfished resources, while maintaining sustainable levels of fishing effort for to ensure a minimal impact on fishing communities.

The supporting materials and analyses used to develop the measures in the proposed management measures are contained in the specifications document and to some degree in previous specifications and/or FMPs as specified in this document.

Describe the review process of the Plan by technically qualified individuals to ensure that the Plan is valid, complete, unbiased, objective and relevant. For example, internal review by staff who were not involved in the development of the Plan to formal, independent, external peer review. The level of review should be commensurate with the importance of the Plan and the constraints imposed by legally enforceable deadlines.

The review process for this specifications package involves the Mid-Atlantic Fishery Management Council, the Northeast Fisheries Science Center (Center), the Northeast Regional Office, and NOAA Fisheries headquarters. The Center's technical review is conducted by senior level scientists with specialties in population dynamics, stock assessment methods, pelagic resources, population biology, and the social sciences. The Council review process involves public meetings at which affected stakeholders have opportunity to provide comments on the specifications document. Review by staff at the Regional Office is conducted by those with expertise in fisheries management and policy, habitat conservation, protected species, and compliance with the applicable law. Final approval of the specifications document and clearance of the rule is conducted by staff at NOAA Fisheries Headquarters, the Department of Commerce, and the U.S. Office of Management and Budget.

PRELIMINARY REGULATORY ECONOMIC EVALUATION (PREE) FOR THE 2004 CATCH SPECIFICATIONS FOR ATLANTIC MACKEREL, SQUID, AND BUTTERFISH

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 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.

2.0 EVALUATION OF E.O. 12866 SIGNIFICANCE

The proposed 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 combined was estimated at $31.4 million in 2002. 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 proposed actions are necessary to maintain the harvest of squid and butterfish at sustainable levels. The proposed action benefits in a material way the economy, productivity, competition and jobs. The proposed 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 proposed actions 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 proposed actions 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 proposed actions do 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.

The economic benefits of the Atlantic Mackerel, Squid and Butterfish FMP have been evaluated periodically as amendments to the FMP have been implemented. These analyses have been conducted at the time a major amendment is developed and interim actions (framework adjustments or quota specifications) may be presumed to leave the conclusions reached in the initial benefit-cost analyses unchanged provided the original conservation and economic objectives of the plan are being met.

Amendment 8 implemented overfishing definitions which are the same or more conservative than overfishing definitions from previous Amendments. As a result, the quota specifications resulting from these new overfishing definitions are the same or lower than in previous years. The economic effects of these overfishing definitions and quota specifications were evaluated at the time Amendment 8 was implemented. The economic analysis presented at that time Amendment 8 implemented was largely qualitative in nature.

For each scenario 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.

Alternative 1 for Atlantic mackerel (2003 Status Quo)

The specifications under this alternative would be ABC = 347,000 mt, IOY=185,000 mt, DAH=185,000 mt, DAP=150,000 mt and JVP=20,000 and TALFF=0 mt.

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

No change in the domestic harvest of Atlantic mackerel would expected as a result of the specifications in 2004 under the status quo alternative.

Prices

Given the likelihood that the status quo alternative for Atlantic mackerel will result in no change in mackerel landings and that mackerel 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.

Consumer Surplus

Assuming Atlantic mackerel 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 as a result of this measure.

Producer surplus

Assuming Atlantic mackerel 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

Properly defined, enforcement costs are not equivalent to the budgetary expense of dockside or at-sea inspection of vessels. Rather, enforcement costs from an economic perspective, are measured by opportunity cost in terms of foregone enforcement services that must be diverted to enforcing regulations. The measures are not expected to change enforcement costs.

Distributive Effects

There are no changes to the quota allocation process for Atlantic mackerel. As such, no distributional effects are identified for this fishery.

Alternative 1 for *Loligo*, *Illex* and Butterfish (2003 status quo and 2004 preferred alternatives)

The specifications for Loligo for 2004-2006 under this alternative would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 17,000 mt and JVP and TALFF = 0 mt. The specifications for *Illex* under this alternative would be Max OY, ABC, IOY, DAH, and DAP = 24,000 mt and JVP and TALFF = 0 mt. The specifications for butterfish under this alternative would be Max OY = 16,000 mt, ABC = 7,200 mt, and IOY, DAH, and DAP = 5,900 mt and JVP and TALFF = 0 mt.

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

No change in the domestic harvest of *Loligo*, *Illex*, or butterfish is expected as a result of the specifications in 2004 under the preferred alternative since these alternatives also represent the status quo.

Prices

Given that the specifications for *Loligo*, *Illex*, and butterfish will result in no change in landings of these species in, it is assumed that there will not be a change in the price for these species.

Consumer Surplus

Assuming *Loligo*, *Illex*, and butterfish 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 as a result of the measures.

Producer surplus

Assuming *Loligo*, *Illex*, and butterfish 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

The measures are not expected to change enforcement costs.

Distributive Effects

There are no changes to the quota or allocation process for *Loligo*, and butterfish. As such, no distributional effects are identified for these fisheries. In the case of *Illex*, the only change in the annual specifications which would affect distribution of the catch is the provision to increase the non-moratorium incidental bycatch allowance to 10,000 pounds per trip during the period when the directed fishery is open. This measure could result in a minor re-distribution of the quota from the directed moratorium category to the non-moratorium incidental catch category. However, this would only be the case if the quota constrained the fishery to point that the directed fishery was closed, which has not occurred since 1998.

Alternative 2 (Preferred alternative for Atlantic mackerel)

For Atlantic mackerel, the specifications under this alternative would be ABC = 347,000 mt, IOY=170,000 mt, DAH=170,000 mt, DAP=150,000 mt and JVP=5,000 and TALFF=0 mt. For *Loligo*, the specifications under alternative 2 would be Max OY =20,000 mt, ABC, IOY, DAH, and DAP = 18,300 mt and JVP and TALFF = 0 mt. For *Illex*, the specifications under alternative 2 would be Max OY, ABC, IOY, DAH, and DAP = 30,000 mt and JVP and TALFF = 0 mt. For butterfish, the specifications under this alternative would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 10,000 mt and JVP and TALFF = 0 mt.

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

Under the alternative 2 measures for these species, none are expected to experience a significant change in landings due to the specifications for the alternative measures proposed in 2004. The landings for the all four species (except *Loligo*) have been below the levels specified for this group under alternative. Therefore, none of the specifications considered by the Council in under alternative 2 for 2004 for Atlantic mackerel, *Illex* , or butterfish are expected to result in an increase or decrease in landings in 2004. However, if 2004 is a year of very high abundance and market conditions are good, *Loligo* landings would be expected to increase in 2004 under alternative 2 relative to the status quo.

Prices

Given the likelihood that the alternative 2 measures for Atlantic mackerel, *Illex* and butterfish would not affect landings in those fisheries, it is assumed that there will not be a change in the price for these species. However, it is possible that given an increase in *Loligo* landings under alternative 2, the price for this species could decrease, holding all other factors equal.

Consumer Surplus

Assuming Atlantic mackerel, *Illex* and butterfish prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with these fisheries under the alternative measures considered. However, given the potential decrease in *Loligo* prices, consumer surplus associated with this fishery may increase under alternative 2.

Harvest Costs

No changes to harvest costs are expected as a result of the alternative 2 measures for any of the four species.

Producer surplus

Assuming Atlantic mackerel, *Illex* and butterfish prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with these fisheries under alternative 2. However, given the potential decrease in *Loligo* prices under alternative 2, producer surplus associated with this fishery may decrease.

Enforcement Costs

The alternative 2 measures are not expected to change enforcement costs.

Distributive Effects

There are no changes to the quota allocation process for Atlantic mackerel, *Loligo, Illex* and butterfish under alternative 2. As such, no distributional effects are expected for these fisheries.

Alternative 3 (most restrictive alternative for each species except butterfish)

The specifications under alternative 3 for Atlantic mackerel would be ABC=134,000 mt, IOY=85,000 mt, DAH=85,000 mt, DAP=50,000 mt and JVP=20,000 and TALFF=0 mt.
The specifications under alternative 3 for *Loligo* would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 13,000 mt and JVP and TALFF = 0 mt. The specifications under alternative 2 for *Illex* would be Max OY =24,000 mt, ABC, IOY, DAH, and DAP = 19,000 mt and JVP and TALFF = 0 mt. The specifications under alternative 2 would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 7,200 mt and JVP and TALFF = 0 mt.

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

Under the alternative measures for these species, only the *Loligo* fishery is expected to experience a significant change in landings due to the specifications for the alternative measures proposed in 2004 under alternative 3. The landings for the other three species have been far below the levels specified for this group under alternative 1,2 or 3. Therefore, none of the specifications considered by the Council in 2004 for Atlantic mackerel, squid or butterfish are expected to result in an increase or decrease in landings in 2004. However, *Loligo* landings would be expected to decrease in 2004 under alternative 3 (i.e., the quota under this alternative would likely constrain the fishery).

Prices

Given the likelihood that the alternative 3 measures for Atlantic mackerel, *Illex* and butterfish would not affect landings, it is assumed that there will not be a change in the price for these species. However, given a decrease in *Loligo* landings under alternative 3, the price for this species could increase.

Consumer Surplus

Assuming Atlantic mackerel, *Illex* and butterfish prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with these fisheries under the alternative measures considered. However, given the potential increase in *Loligo* prices, consumer surplus associated with this fishery may decrease under alternative 3.

Harvest Costs

No changes to harvest costs are expected as a result of alternative 3 for Atlantic mackerel, *Illex* and butterfish. For *Loligo*, the economic inefficiencies associated with a derby fishery created by a low quota would likely be a result of alternative 3. These economic inefficiencies would probably include increased harvest costs due to the race to catch fish under derby conditions.

Producer surplus

Assuming Atlantic mackerel, *Illex* and butterfish prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with these fisheries under alternative 3. However, given the potential increase in *Loligo* prices under alternative 3, producer surplus associated with this fishery may increase.

Enforcement Costs

The alternative 3 measures are not expected to change enforcement costs.

Distributive Effects

there are no changes to the quota allocation process for Atlantic mackerel, *Loligo, Illex* and butterfish under alternative 3. As such, no distributional effects are identified for these fisheries.

Summary of Impacts

The overall impacts of Atlantic mackerel, *Loligo, Illex* and butterfish landings on prices, consumer surplus, and consumer surplus are difficult to determine without detailed knowledge of the relationship between supply and demand factors for these fisheries. In the absence of detailed empirical models for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach was employed to assess potential impacts of the management measures.

The impact of each the regulatory alternatives relative to the base year (2002) is summarized in Table IRFA-1. When potential outcomes from implementing a specific alternative are equal for all three species in direction, the resulting directional effect is presented as zero. However, when outcomes from implementing a specific alternative differ across species, the directional effects will be presented separately for each species. A “-1" indicates that the level of the given feature would be reduced given the action as compared to the base year. A “+1" indicates that the level of the given feature would increase relative to the base year and a “0" indicates no change. In this analysis, the base line condition was 2002 landings. This comparison will allow for the evaluation of the potential fishing opportunities associated with each alternative in 2004 versus the fishing opportunities that occurred in 2002.

The status quo alternative, preferred alternative, and alternative 2 may be expected to have similar overall impacts (i.e., none are expected as a result of the quota specifications under each of these alternatives). Likewise, under alternative 3, no impacts for Atlantic mackerel, *Illex* and butterfish are expected. However, alternative 3 for *Loligo* shows an increase in prices associated with lower landings in 2004 compared to 2002. As such, consumer surplus is expected to decrease and producer surplus is expected to increase.

No changes in the competitive nature of these fisheries is expected to occur if any of these management measures were implemented. All the alternatives would maintain the competitive structure of the fishery, that is, there are no changes in the manner the quotas are allocated by quarter. However, the large reductions in the quota level under alternative 3 for *Loligo* may affect vessels engaged in that fishery differently due to their capability to adjust to quota changes.

No changes in enforcement costs or harvest costs have been identified for alternative 1 and 2. Under alternative 3 for *Loligo*, harvest costs could increase as a result of derby fishing conditions created under this alternative.

It is important to mention that although the measures that are evaluated in this specification package are for the 2004 fisheries, the annual specification process for these fisheries could have potential cumulative impacts. The extent of any cumulative impacts from measures established in previous years is largely dependent on how effective those measures were in meeting their intended objectives and the extent to which mitigating measures compensated for any quota overages. Section 6.0 of the EA has a description or historical account of cumulative impacts of the measures established under the FMP since it was implemented .

Table IRFA-1. Qualitative comparative summary of economic effects of regulatory alternatives for Atlantic mackerel squid and butterfish in 2004 relative to 2002.

Feature	Alternative 1 Mackerel	Alternative 1 *Loligo*, *Illex* and Butterfish	Alternative 2 Mackerel, *Loligo*, *Illex* and Butterfish	Alternative 3 Mackerel, (M) *Loligo* (L), *Illex* (I) and Butterfish (B)
Landings	0	0	0	M,I,B=0;L=-1
Prices	0	0	0	M,I,B=0;L=+1
Consumer Surplus	0	0	0	M,I,B=0;L=-1
Harvest Costs	0	0	0	M,I,B=0;L=+1
Producer Surplus	0	0	0	M,I,B=0;L=+1
Enforcement Costs	0	0	0	M,I,B,L=0
Distributive Impacts	0	0	0	M,I,B,L=0
"-1" denotes a reduction relative 2002; "0" denotes no change relative 2002; and "+1" denotes an increase relative to 2002.				

3.0 INITIAL REGULATORY FLEXIBILITY ANALYSIS

3.1 INTRODUCTION AND METHODS

The Regulatory Flexibility Act (RFA) requires the Federal rulemaker to examine the impacts of proposed and existing rules on small businesses, small organizations, and small governmental jurisdictions. In reviewing the potential impacts of proposed regulations, the agency must either certify that the rule "will not, if promulgated, have a significant economic impact on a substantial number of small entities or prepare an initial regulatory flexibility analysis." 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 $3.0 million. The measures regarding the 2004 quotas could affect any vessel holding an active Federal permit for Atlantic mackerel, *Loligo, Illex* or butterfish (see Table IRFA-2 below), as well as vessels that fish for any one of these species in state waters. According to 2003 NMFS permit file data, 2,407 commercial vessels were holding Atlantic mackerel permits, 381 vessels were holding *Loligo*/butterfish moratorium permits, 72 vessels possessed *Illex* permits, 2119 vessels held incidental catch permits. All of these vessels readily fall within the definition of small business. In addition, the 2004 quotas could affect any dealer which holds a federal Atlantic mackerel, squid and butterfish dealer permit. According to 2003 NMFS permit file data, there were 362 dealers which possessed federal Atlantic mackerel, squid and butterfish dealer permits. The proposed DAH specifications (Alternative 2) of 170,000 mt for Atlantic mackerel, 24,000 mt for *Illex* squid, and 5,900 mt for butterfish represent no constraint on vessels in these fisheries. The level of landings allowed under the proposed specifications for 2004 has not been achieved by vessels in these fisheries in recent years. From 1998-2002, Loligo squid landings averaged 16,631 mt. If the 2004 proposed DAH specification of 17,000 mt for Loligo squid is achieved, there would be an increase in catch and revenue in the Loligo squid fishery relative to the average landings from 1998-2002. Absent such a constraint, no impacts on revenues are

expected as a result of the proposed actions.
Table IRFA-2. Number of vessels which landed Atlantic mackerel, *Loligo*, *Illex*, and butterfish by permit category in 2002.

		Vessel Which Landed			
Permit Category	(n)	Mackerel	*Loligo*	*Illex*	Butterfish
Mackerel	(2407)	312	305	24	310
Loligo/Butterfish	(381)	162	267	26	225
Illex	(72)	30	54	11	44
Incidental	(2119)	210	206	13	215

(Source: Unpublished NMFS permit and dealer data).

Since all permit holders may not actually land any of the four species, the more immediate impact of the specifications may be felt by the commercial vessels that are actively participating in these fisheries (see Table RIR-1). An active participant was defined as being any vessel that reported having landed one or more pounds of any one of the four species in the Northeast dealer data during calendar year 2002. The dealer data covers activity by unique vessels that hold a Federal permit of any kind and provides summary data for vessels that fish exclusively in state waters. This means that an active vessel may be a vessel that holds a valid Federal Atlantic mackerel, squid, or butterfish permit, a vessel that holds a valid Federal permit but no Atlantic mackerel, squid, or butterfish permit; a vessel that holds a Federal permit other than Atlantic mackerel, squid, or butterfish permit and fishes for those species exclusively in state waters; or may be a vessel that holds no Federal permit of any kind. Of the four possibilities the number of vessels in the latter two categories cannot be estimated because the dealer data provides only summary information for state waters vessels and because the vessels in the last category do not have to report landings.

In the present IRFA the primary unit of observation for purposes of performing a threshold analysis is vessels that landed any one or more of the four species during calendar year 2002 irrespective of their permit status.

Not all landings and revenues reported through the Federal dealer data can be attributed to a specific vessel. Vessels with no Federal permits are not subject to any Federal reporting requirements with which to corroborate the dealer reports. Similarly, dealers that buy exclusively from state waters only vessels and have no Federal permits, are also not subject to Federal reporting requirements. Thus, it is possible that some vessel activity cannot be tracked with the landings and revenue data that are available. Thus, these vessels cannot be included in the threshold analysis, unless each state were to report individual vessel activity through some additional reporting system - which currently does not exist. This problem has two consequences for performing threshold analyses. First, the stated number of entities subject to the regulation is a lower bound estimate, since vessels that operate strictly within state waters and sell exclusively to non-Federally permitted dealers cannot be counted. Second, the portion of activity by these uncounted vessels may cause the estimated economic impacts to be over- or underestimated.

The effects of actions were analyzed by employing quantitative approaches to the extent possible. In the current analysis, effects on profitability associated with the management measures should be evaluated by looking at the impact the measures on individual vessel costs and revenues. However, in the absence of cost data for individual vessels engaged in these fisheries, changes in gross revenues are used a proxy for profitability.

Procedurally, the economic effects of the quota alternatives were estimated as follows. First, the Northeast dealer data were queried to identify all vessels that landed at least one or more pounds of Atlantic mackerel, squid, or butterfish permit in calendar year 2002.

The second step was to estimate total revenues from all species landed by each vessel during calendar year 2002. This estimate provides the base from which subsequent quota changes and their associated effects on vessel revenues were compared. Since 2002 is the last full year from which data are available (partial year data could miss seasonal fisheries), it was chosen as the base year for the analysis. That is, partial landings data for 2003 were not used in this analysis because the year is not complete. As such, 2002 data were used as a proxy for 2003.

The third step was to deduct or add, as appropriate, the expected change in vessel revenues depending upon which of the quota alternatives were evaluated. This was accomplished by estimating proportional reductions or increases in the quota alternatives versus the base year 2002 (2003 proxy).

The fourth step was to divide the estimated 2004 revenues from all species by the 2002 base revenues for every vessel in each of the classes. For each quota alternative a summary table was constructed that report the results of the threshold analysis. These results were further summarized by home state as defined by permit application data when appropriate.

The threshold analysis just described is intended to identify impacted vessels and to characterize the potential economic impact on directly affected entities. In addition, analyses were conducted to assess disproportionality issues. Specifically, disproportionality was assessed by evaluating if a regulation places a substantial number of small entities at a significant competitive disadvantage. Disproportionality is judged to occur when a proportionate affect on profits, costs, or net revenue is expected to occur for a substantial number of small entities. As noted above, gross revenue used as a proxy for profits due lack of cost date for individual vessels. In the current analysis, alternative 3 for *Loligo* was the only alternative judged to have possible disproportionate effects which are discussed in section 3.2.3.

To further characterize the potential impacts on indirectly impacted entities and the larger communities within which owners of impacted vessels reside, selected county profiles are typically constructed. Counties included in the profile typically meet the following criteria: the number vessels with revenue loss exceeding 5 percent per county was either greater than 4, or all impacted vessels in a given state were from the same home county. However, as indicated in the threshold analysis conducted in section 3.2.4 below, there was only one county identified as having enough impacted vessels to meet the criteria specified.

A description of important ports and communities to the Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries is presented in section Appendix 1 of this document. Counties are typically selected as the unit of observation because a variety of secondary economic and demographic statistical data were available from several different sources.

3.2 ANALYSIS OF THE IMPACTS OF ALTERNATIVES

For the purpose of ease of comparison, the specifications in previous years compared to actual fishery performance are given by species in the Tables IRFA 3-6 below.

Table IRFA-3. Summary of Specifications and Landings for Atlantic Mackerel (mt).

	1999	2000	2001	2002	2003
ABC	383,000[1]	347,000[1]	347,000[1]	347,000[1]	347,000[1]
IOY	75,000	75,000	88,000	85,000	175,000
DAH	75,000[2]	75,000[2]	85,000[2]	85,000	175,000
DAP	50,000	50,000	50,000	50,000	150,000
JVP	10,000	10,000	20,000	10,000	10,000
TALFF	0	0	3,000	0	0
US Commercial	12,045	5,645	12,308	26,192	27,203[3]
US Value (m $)	3.6	2.0	2.2	6.1	-
US Recreational	1,335	1,448	1,536	1,285	-
Total US	13,375	7,093	13,844	-	-
Canadian	16,561	13,383	23,868	27,477	-

[1] ABC = 369,000 - 22,000 (F_{target} - Canadian).
[2] Includes recreational allocation of 15,000 mt.
[3] Preliminary landings as of April 30, 2003 based on NMFS Dealer Reports (Cofone, pers. comm.).

Table IRFA-4. Summary of specifications and landings for *Loligo* (mt).

	1998	1999	2000	2001	2002	2003
Max OY	26,000	26,000	26,000	26,000	26,000	26,000
ABC	21,000	21,000	13,000[3]	17,000	17,000	17,000
IOY	21,000	21,000	13,000[3]	17,000	17,000	17,000
DAH	21,000	21,000	13,000[3]	17,000	17,000	17,000
DAP	21,000	21,000	13,000[3]	17,000	17,000	17,000
JVP	0	0	0	0	0	0
TALFF	0	0	0	0	0	0
Landings (mt)	18,385	18,674	16,915	13,983	16,201	4,913[4]
Value (millions $)	32.2	32.1	24.1	20.3	22.9	-

[1] Proposed for 2004-2006. If quota set-aside research projects are approved by December 31, 2003, up to 3% of ABC, IOY, DAH and DAP for 2003 may be set-aside for scientific research. If a research set- aside is approved each year, the amount specified for RSA will be deducted from IOY, DAH and DAP.
[2] Reduced to 26,000 mt when overfishing threshold in Amendment 6 was approved.
[3] Increased from 13,000 mt to 15, 000 mt by an in-season adjustment.
[4] Preliminary landings as of April 30, 2003 based on NMFS Dealer Reports (Cofone, pers. comm.).

Table IRFA-5. Summary of specifications and landings for *Illex* (mt).

	1998	1999	2000	2001	2002	2003
Max OY	24,000	24,000	24,000	24,000	24,000	24,000
ABC	19,000	19,000[2]	24,000	24,000	24,000	24,000
IOY	19,000	19,000[2]	24,000	24,000	24,000	24,000
DAH	19,000	19,000[2]	24,000	24,000	24,000	24,000
DAP	19,000	19,000[2]	24,000	24,000	24,000	24,000
JVP	0	0	0	0	0	0
TALFF	0	0	0	0	0	0
Landings (mt)	22,706	7,361	9,041	3,938	2,723	<1[3]
Value (millions $)	9.2	3.9	3.7	1.8	1.4	-

[1] Proposed for 2004. If quota set-aside research projects are approved by December 31, 2003, up to 3% of ABC, IOY, DAH and DAP for 2004 may be set-aside for scientific research.
[2] 22,800 mt when Amendment 8 was approved.
[3] Preliminary landings as of April 30, 2003 based on NMFS Dealer Reports (Cofone, pers. comm.).

Table IRFA-6. Summary of specifications and landings for butterfish (mt).

	1998	1999	2000	2001	2002	2003
Max OY	16,000	16,000	16,000	16,000	16,000	16,000
ABC	7,200	7,200	7,200	7,200	7,200	7,200
IOY	5,900	5,900	5,900	5,900	5,900	5,900
DAH	5,900	5,900	5,900	5,897	5,900	5,900
DAP	5,900	5,900	5,900	5,897	5,900	5,900
JVP	0	0	0	0	0	0
TALFF[2]	0	0	0	3	0	0
Landings (mt)	1,964	2,116	1,432	4,373	841	162[2]
Value (millions $)	2.5	2.7	1.5	3.2	0.9	-

[1] Proposed for 2004. If quota set-aside research projects are approved by December 31, 2003, up to 3% of ABC, IOY, DAH and DAP for 2004 may be set-aside for scientific research.
[2] Preliminary landings as of April 30, 2003 based on NMFS Dealer Reports (Cofone, pers. comm.).

3.2.1 Impacts of Alternative 1(no action/2003 status quo)

The specifications under this alternative for Atlantic mackerel would be ABC = 347,000 mt, IOY=175,000 mt, DAH=175,000 mt, DAP=150,000 mt and JVP=10,000 and TALFF=0 mt. The specifications under this alternative for *Loligo* would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 17,000 mt and JVP and TALFF = 0 mt. The specifications for *Illex* under this alternative would be Max OY, ABC, IOY, DAH, and DAP = 24,000 mt and JVP and TALFF = 0 mt. The specifications for butterfish under this alternative would be Max OY = 16,000 mt, ABC = 7,200 mt, and IOY, DAH, and DAP = 5,900 mt and JVP and TALFF = 0 mt.

In the case of the status quo specifications for Atlantic mackerel, *Loligo, Illex* and butterfish the 2003 specifications of IOY exceed landings of the species for 2002. Therefore, the 2003 quota specifications for the Atlantic mackerel, *Loligo*, *Illex* and butterfish fisheries represented no constraint on vessels in the fishery in aggregate or individually. Therefore, specification of the 2003 status quo alternative in 2004 would represent no constraint on vessels in the fishery in aggregate or individually. In the absence of such constraints, there is no impact on revenues under the Regulatory Flexibility Act. As a result, the status quo specifications for Atlantic mackerel, *Loligo*, *Illex* and butterfish will have no negative impacts on businesses involved in the commercial harvest of Atlantic mackerel *Loligo*, *Illex* and butterfish.

3.2.2 Impacts of Alternative 2

The specifications under alternative 2 for Atlantic mackerel would be ABC = 347,000 mt, IOY=170,000 mt, DAH=150,000 mt, DAP=150,000 mt and JVP=5,000 and TALFF=0 mt. The specifications under alternative for *Loligo* would be Max OY =20,000 mt, ABC, IOY, DAH, and DAP = 18,300 mt and JVP and TALFF = 0 mt. The specifications under alternative 2 for *Illex* would be Max OY, ABC, IOY, DAH, and DAP = 30,000 mt and JVP and TALFF = 0 mt. The specifications under alternative 2 for butterfish would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 10,000 mt and JVP and TALFF = 0 mt. This represents the least restrictive alternative in terms of ABC (the upper limit of the annual quota) for *Loligo*, *Illex* and butterfish which was considered by the Council.

The ABC specifications for each species under alternative 2 exceed the landings of each respective species in 2002(see section 3.3.2 above). Therefore, the 2004 quota specifications for the each fishery under alternative 2 would represent no constraint on vessels in these fisheries in aggregate or individually. In the absence of such constraints, there are no impacts on revenues under the Regulatory Flexibility Act. As a result, the specifications under alternative 2 for Atlantic mackerel, *Loligo*, *Illex*, and butterfish will have no negative impacts on businesses involved in the commercial harvest of these species. It is possible that in the case of the reduced Atlantic mackerel JVP specification under this alternative, that catcher vessels may well be indifferent between selling to foreign or domestic buyers.

3.2.3 Impacts of Alternative 3

The specifications under alternative 3 for Atlantic mackerel would be ABC=134,000 mt, IOY=85,000 mt, DAH=85,000 mt, DAP=50,000 mt and JVP=20,000 and TALFF=0 mt. The specifications under alternative 3 for *Loligo* would be Max OY =26,000 mt, ABC, IOY, DAH, and DAP = 13,000 mt and JVP and TALFF = 0 mt. The specifications under alternative 2 for *Illex* would be Max OY =24,000 mt, ABC, IOY, DAH, and DAP = 19,000 mt and JVP and TALFF = 0 mt. The specifications under alternative 2 would be Max OY = 16,000 mt, and ABC, IOY, DAH, and DAP = 7,200 mt and JVP and TALFF = 0 mt.

The ABC specifications for Atlantic mackerel, *Illex* and butterfish under alternative 3 exceed the landings of each respective species in 2001 (see section 3.3.2 above). Therefore, the 2003 quota specifications for the each fishery under alternative 3 would represent no constraint on vessels in these fisheries in aggregate or individually. In the absence of such constraints, there are no impacts on revenues under the Regulatory Flexibility Act. As a result, the specifications under alternative 2 for Atlantic mackerel, *Illex*, and butterfish will have no negative impacts on businesses involved in the commercial harvest of these species.

Under alternative 3, the *Loligo* fishery is expected to experience a reduction in landings due to the specifications for the alternative measures proposed for in 2004. *Loligo* landings would be expected to decrease in 2004 under alternative 3 relative to the 2002fishery (i.e., the quota under this alternative would constrain the fishery). Under alternative 3 for *Loligo* in 2004, IOY, DAH and DAP would be reduced to 13,000mt. The Council would choose, in effect, to specify ABC for 2004 at 90% of F_{msy} or 13,000 mt based on stock size information available in 1999. This specification represents a 20.1 % reduction in landings relative to the 2002 landings of *Loligo*. Therefore, this ABC specification for *Loligo* in 2004 would likely result in a reduction in revenue greater than 5% for vessels engaged in the directed fishery for *Loligo*.

Of the 426 vessels which reported landing *Loligo* 2002, 110 vessels would be expected to experience a reduction in total gross revenues (all species combined) greater than 5% as a result of the 20.1 % reduction in the *Loligo* quota under this alternative (Table 39). This represents 25.8% of the vessels which landed *Loligo* during 2002. The remaining vessels (316 or 74.1%) were expected to experience a reduction in total gross revenues (all species combined) of less than 5% as a result of the 20.1% reduction in the *Loligo* quota under this alternative.

As noted above, 110 vessels would be expected to experience a reduction of total gross revenues of greater than 5% due a 13,000 mt *Loligo* quota in 2004. The size distribution of all vessels (in terms of length and gross registered tonnage) which landed *Loligo* during the 2002 is presented in Table 40. Of the 426 vessels that reported landing *Loligo* in 2002, vessel attributes for vessel length and gross registered tonnage were available for 416 vessels from unpublished NMFS permit file data. In terms of length, about 76% of those vessels were less than 75 ft in length, while the remaining vessels (24%) were greater than 75 ft. A comparison of the length distribution of vessels affected by the quota of 13,000 mt in 2004 under Alternative 3 for *Loligo* (i.e., those vessels expected to experience a reduction in total gross revenues (all species combined) of greater than 5 %) indicated that the impact of the quota reduction appeared to be equal across all length and tonnage classes (Table 40). That is, a comparison of the frequency distributions of length and ton class for the total pool of vessels which landed *Loligo* and those affected by the alternative quota of 13,000 mt indicated that there were no disproportionate effects by vessel size class. For example, 24.1% of all vessels which landed *Loligo* in 2002 were 25-49 ft in length while 22% of the affected vessels in 2002 were in this length class. This comparison yields similar conclusions across all length and ton classes of vessels in the fishery.

Descriptive data for vessels which landed *Loligo* in 2002 relative to home port state and , principal port of landing state are given in Tables 41 and 42. Tables 41 and 42 also provide a relative comparison of the same data for vessels expected to be affected by the alternative quota of 13,000 mt for *Loligo* in 2004. Overall, New York and Rhode Island appear to be the most heavily impacted states. For example, in terms of principal port of landing, vessels landing in New York ports accounted for 18.5% of all vessels landing *Loligo* in 2002. However, vessels landing in New York ports would be expected to account for 39.4% of vessels affected under the alternative 3 quota of 13,000 mt for *Loligo* in 2003. Similarly, Rhode Island ports accounted for 25.5% of all vessels landing *Loligo* in 2002, but would be expected to account for 35.8% of vessels affected under the alternative 3 quota of 13,000 mt for *Loligo* in 2003.

3.2.4 County Impacts

To further characterize the potential impacts on indirectly impacted entities and the larger communities within which owners of impacted vessels reside, selected county profiles are typically constructed. Each profile is based on impacts under the most restrictive possible alternative. The most restrictive alternative is chosen to identify impacted counties because it would identify the maximum number possible and thus include the broadest possible range of counties in the analysis. Counties included in the profile typically meet the following criteria: the number of impacted vessels (vessels with revenue loss exceeding 5 percent) per county was either greater than 4, or all impacted vessels in a given state were from the same home county. Based on the threshold analysis described above, there were six counties under alternative 3 for *Loligo* which were identified as having enough impacted vessels to meet the criteria specified. The following counties were identified as being impacted: Washington, RI (26 vessels); Suffolk, NY (23 vessels); New York, NY (18 vessels); Suffolk, MA (7 vessels); Newport, RI (7 vessels); Cape May, NJ (6 vessels). A complete description of the ports and communities found in these counties is given in Appendix 1.

References

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.

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.

Bigelow, H.B., and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. Fishery Bulletin, U.S. 53:417-423

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.

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.

Christensen, D.J., W.J. Clifford, P.G. Scarlett, R.W. Smith, and D. Zachea. 1979. A survey of the 1978 spring recreational fishery for the Atlantic mackerel, *Scomber scombrus*, in the Middle Atlantic region. NMFS Sandy Hook Lab Report No. 78-43. 22 p.

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. and P.C. Beck. 1992. Population structure, growth, and sexual maturation of short-finned squid (Illex illecebrosus). ICES CM 1993/K:33.

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.

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.

Gregoire, F. 1996. Mackerel in the Northwest Atlantic. Stock Status Report 96/24. Dept. of Fisheries and Oceans, Quebec Canada. 15p.

Grosslein, M.D. and T.R. Azarovitz. 1982. Fish distribution. MESA New York Bight Atlas Monograph 15. 182 p.

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

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.

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.

Lange, A.M.T. 1984. An assessment of the long-finned squid resource off the northeastern United States - Autumn 1984. NMFS, NEFC, Woods Hole Lab. Ref. Doc.84-37. 24 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(7-8): 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.

Lux, F.E. and W.D. Handwork and W.J. Rathjen. 1974. The potential for an offshore squid fishery in New England. Mar. Fish. Rev. 36(12): 24-27.

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.
Macy, W.K. III. 1992. Preliminary age determination of the squid, *Loligo pealei*, using digital imaging. ICES CM 1992/K:, 9 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.

McCay, Bonnie J., Bryan Oles, Brent Stoffle, Eleanor Bochenek, Kevin St.Martin, Giovani Graziosi, Teresa Johnson, and Johnelle Lamarque. 2002. Port and Community Profiles, Amendment 9, Squid, Atlantic Mackerel, and Butterfish FMP. A Report to the Mid-Atlantic Fishery Management Council. The Fisheries Project, Rutgers the State University, New Brunswick, New Jersey, June 27, 2002.

Mesnil, B. 1977. Growth and life cycle of squid, *Loligo pealei* and *Illex illecebrosus,* from the Northwest Atlantic. NAFO Research Document 76/VI/65.

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. 1978. The fecundity of Atlantic mackerel, *Scomber scombrus*, in the Middle Atlantic Bight. Fish. Bull., 78: 103-108.

Murison, L.D., and D.E. Gaskin. 1989. The distribution of right whales and zooplankton in the Bay of Fundy, Canada. Can. J. Zool. 67:1411-1420.

Murawski S.A. and G.T. Waring. 1979. A population assessment of butterfish, *Peprilus triacanthus*, in the Northwest Atlantic Ocean. Tran. Am. Fish. Soc. 108(5): 427-439.

NMFS. 1994. Report of 17th NEFSC Stock Assessment Workshop. NEFSC, Woods Hole Lab. Ref. Doc. 94-03.

NMFS. 1996. Draft Report of the 20th Northeast Regional Stock Assessment Workshop, Northeast Fishery Science Center. Woods Hole, MA.

NMFS. 1996. Report of the 21th Northeast Regional Stock Assessment Workshop, Northeast Fishery Science Center. Woods Hole, MA. June 1996.

NMFS. 1998. Guidelines for Regulatory Analysis of Fishery Management Actions. Office of Sustainable Fisheries, National Marine Fisheries Service, Silver Spring, Maryland 20910. Revised April 15, 1998.

NMFS. 1999. Report of the 29th Northeast Regional Stock Assessment Workshop, Northeast Fishery Science Center. Woods Hole, MA. June 1999.

NMFS. 2001. Report of the 34th Northeast Regional Stock Assessment Workshop, Northeast Fishery Science Center. Woods Hole, MA. June 1999.

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.

Okutani, T. 1977. Stock assessment of cephalopod resources fished by Japan. FAO Fish. Tech. paper No. 173. 62 p.

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 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.

Overholtz, W.J., R.S. Armstrong, D.G. Mountain, and M. Terceiro. 1991. Factors influencing spring distribution, availability, and recreational catch of Atlantic mackerel (*Scomber scombrus*) in the Middle Atlantic and southern New England regions. NOAA Tech. Memo. NMFS-FNEC-85. 13 p.

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.

Pentilla, J.A. and E.D. Anderson. 1976. Mackerel age-length keys from the 1973-76 bottom trawl surveys in SA 5-6. Int. Comm. Northw. Atlantic Fish., Res. Doc. 76/XII/148, Ser. No. 4044.

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.

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.

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.

Serchuck 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. Mar. Fish. Rev., 36(1): 10-17.

Sette, O.E. 1950. Biology of the Atlantic mackerel *Scomber scombrus* of North America. Part 2. Migrations and habits. U.S. Fish. Bull. 50(38): 251-358.

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.

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.

Summers, W.C. 1968. The growth and size distribution of the current year class *Loligo pealei*. Biol. Bull. 137(1): 366-377.

Summers, W.C. 1983. *Loligo pealei*, pp 115-142. In: Cephalopod Life Cycles, Vol. I. Academic Press, London.
United States Department of Commerce (USDC). 1990. Fisheries of the United States, 1989. Current Fishery Statistics No. 8900. NOAA. NMFS. 111 p.

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.

USDC. 1994. Fisheries of the United States, 1993. Current Fishery Statistics No. 9300. NOAA. NMFS. 121 p.

USDC. 1994a. Imports and exports of fishery products annual summery, 1994. Current Fishery Statistics No. 9402. NOAA. NMFS. 23 p.

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.

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. 1975. A preliminary analysis of the status of the butterfish in ICNAF subarea 5 and statistical area 6. International Commission for the Northwest Atlantic Fisheries. Res. Doc. 74/74, Dartmouth, Canada.

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.

Table 1. Landings of Atlantic mackerel by state in 2002 based on unpublished NMFS dealer reports.

State	Landings (mt)	Percent of Total
RI	9,523	36.4%
NJ	9,293	35.5%
JV	4,744	18.1%
MA	2,517	9.6%
NY	85	0.3%
CT	14	0.1%
ME	7	0.0%
VA	5	0.0%
MD	2	0.0%
NC	1	0.0%
NH	1	0.0%
DE	0	0.0%
Total	26,192	100.0%

Source: Unpublished NMFS dealer reports.

Table 2. Landings of Atlantic mackerel by month in 2002 based on unpublished NMFS dealer reports.

Month	Landings (mt)	Percent of Total
1	2,711	10.3%
2	8,484	32.4%
3	10,559	40.3%
4	3,142	12.0%
5	474	1.8%
6	20	0.1%
7	3	0.0%
8	5	0.0%
9	9	0.0%
10	3	0.0%
11	12	0.0%
12	770	2.9%
Total	26,192	100.0%

Source: Unpublished NMFS dealer reports.

Table 3. Landings of Atlantic mackerel by gear in 2002 based on unpublished NMFS dealer reports.

Gear Category	Landings	Percent of Total
TRAWL, OTTER, MIDWATER	21,834	83.4%
TRAWL, OTTER, BOTTOM	3,981	15.2%
POTS AND TRAPS	140	0.5%
POUND NET	113	0.4%
GILL NET	67	0.3%
HOOK AND LINE	55	0.2%
UNKNOWN	1	0.0%
SEINE	0	0.0%
Total	26,192	100.0%

Source: Unpublished NMFS dealer reports.

Table 4. Atlantic mackerel landings by port in 2002.

Port	Landings (mt)	Percent of Total
CAPE MAY, NJ	9,053	34.6%
PORTSMOUTH, RI	5,645	21.6%
DOMESTIC JOINT VENTURE, JV	4,744	18.1%
NORTH KINGSTOWN, RI	3,613	13.8%
GLOUCESTER, MA	2,348	9.0%
POINT JUDITH, RI	214	0.8%
SEA ISLE CITY, NJ	169	0.6%
CHATHAM, MA	114	0.4%
NEW BEDFORD, MA	50	0.2%
PT. PLEASANT, NJ	40	0.2%
OTHER	202	0.8%
TOTAL	26,192	100.0%

Source: Unpublished NMFS dealer reports.

Table 5. Value of landings all species landed and Atlantic mackerel by port in 2002 (for ports where mackerel comprised >1% of total value of all species and total port value for mackerel exceeded $25,000).

Port	Vessels	Value All Species	Value Mackerel Only	Percent
PORTSMOUTH, RI	3	1,295,140	1,244,487	96.09
DOMESTIC JOINT VENTURE, JV	6	1,082,043	522,885	48.32
NORTH KINGSTOWN, RI	3	6,411,123	1,675,850	26.14
CAPE MAY, NJ	6	26,772,375	1,693,027	6.32
SEA ISLE CITY, NJ	1	1,047,161	32,068	3.06
GLOUCESTER, MA	40	30,041,564	582,859	1.94
CHATHAM, MA	27	7,660,682	91,031	1.19

Source: Unpublished NMFS dealer reports.

Table 6. Atlantic mackerel vessel permit holders in 2002, by home port state.

Home Port State	Number of Vessels	Percent of Total
MA	1001	41.59%
ME	250	10.39%
NY	224	9.31%
NJ	168	6.98%
RI	142	5.90%
VA	107	4.45%
NC	100	4.15%
NH	89	3.70%
CT	44	1.83%
MD	19	0.79%
FL	20	0.83%
PA	26	1.08%
DE	16	0.66%
WA	3	0.12%
GA	2	0.08%
SC	1	0.04%
VT	2	0.08%
MS	1	0.04%
TX	1	0.04%
WV	1	0.04%
UN	190	7.89%
Total	2407	100.0

Source: Unpublished NMFS permit data

Table 7. Atlantic mackerel, squid and butterfish dealer permit holders in 2002, by state.

State	Dealers	Percent of Total
MA	99	27.3
NY	70	19.3
NJ	39	10.8
RI	39	10.8
NC	31	8.6
ME	28	7.7
VA	23	6.4
NH	7	1.9
CT	5	1.4
FL	4	1.1
DE	3	0.8
MD	3	0.8
PA	3	0.8
LA	2	0.6
PR	2	0.6
AL	1	0.3
CA	1	0.3
TX	1	0.3
VI	1	0.3
Total	362	100.0

Source: Unpublished NMFS permit data.

Table 8. Atlantic mackerel, squid and butterfish dealer permit holders who bought Atlantic mackerel in 2002, by state.

State	Dealers	Percent of Total
MA	29	26.9
NY	25	23.1
RI	25	23.1
NC	9	8.3
NJ	9	8.3
ME	3	2.8
VA	3	2.8
MD	2	1.9
NH	2	1.9
CT	1	0.9
Total	108	100.0

Source: Unpublished NMFS dealer reports and permit data.

Table 9. Total landings and value of Atlantic mackerel, Loligo, *Illex* and butterfish in 2002.

Species	Landings (mt)	Value ($)	Number of Vessels	Number of Trips
MACKEREL, ATLANTIC	26,192	6,129,187	408	3,096
SQUID (LOLIGO)	16,280	22,997,923	426	13,844
SQUID (ILLEX)	2,723	1,404,501	36	94
BUTTERFISH	841	968,514	453	10,294

Source: Unpublished NMFS dealer reports.

Table 10. Total landings of Atlantic mackerel, Loligo, Illex and butterfish during 2002 by permit category.

	Permit Categories						
	Loligo / Butterfish Moratorium		Squid / Butterfish Incidental Catch		Atlantic Mackerel		
Species	Landings (mt)	Number of Vessels	Landings (mt)	Number of Vessels	Landings (mt)	Number of Vessels	L
MACKEREL, ATLAN-TIC	15,780	162	8,972	210	25,933	312	
SQUID (LOLIGO)	15,717	267	3,687	206	14,163	305	
SQUID (ILLEX)	2,721	26	2	13	2,721	24	
BUTTERFISH	701	225	219	215	654	310	
Total	31,497	429	12,659	416	40,097	617	

Source: Unpublished NMFS dealer reports and permit data.

Table 11. Recreational landed and released Atlantic mackerel, 1981-2002.

	Landings		Releases
Year	Pounds	No. fish	No. fish
1981	7,076,715	4,919,093	189,043
1982	2,624,984	1,533,059	9,771
1983	6,617,920	3,995,716	123,668
1984	5,113,102	3,448,940	376,296
1985	5,981,585	7,169,547	654,993
1986	9,310,839	5,275,651	112,320
1987	8,888,617	6,399,372	1,334,022
1988	7,197,549	5,548,553	450,732
1989	3,938,824	3,613,474	421,614
1990	4,115,807	3,688,023	303,218
1991	5,656,706	5,235,308	219,879
1992	625,959	809,137	229,607
1993	1,321,726	2,119,621	185,452
1994	3,759,548	4,567,433	292,669
1995	2,753,911	3,241,051	875,962
1996	2,954,980	3,039,779	401,836
1997	3,828,533	4,549,865	643,830
1998	1,520,085	1,874,380	339,076
1999	2,943,372	3,235,841	402,362
2000	3,191,829	4,193,781	672,651
2001	3,385,624	4,127,148	795,585
2002	2,833,956	3,638,461	398,394

Source: MRFSS.

Table 12. Recreational landings (metric tons) of Atlantic mackerel by state, 1981-2002.

STATE	ME	NH	RI	MA	CT	NY	NJ	DE	MD	VA
1981	383.9	99.5	32.0	239.1	112.2	67.5	2275.7	0.0	0.0	0.
1982	23.5	80.6	27.2	24.0	227.6	101.4	706.5	0.0	0.0	0.
1983	77.3	51.1	123.4	243.8	0.0	0.2	430.3	47.2	392.7	1618.
1984	138.7	172.4	157.6	312.8	1.6	20.5	731.9	605.3	170.8	7.
1985	1110.0	83.9	162.6	507.4	39.9	35.5	752.5	8.5	0.0	12.
1986	133.4	14.3	46.1	628.7	36.5	22.7	1839.3	775.0	0.0	487.
1987	318.5	55.3	0.1	485.4	330.6	1681.8	992.3	0.0	132.0	35.
1988	538.7	72.6	5.5	1952.5	2.0	0.0	1.0	524.9	159.3	0.
1989	147.2	73.8	9.9	877.5	0.2	119.0	253.1	106.7	194.9	4.
1990	79.7	65.6	41.7	1009.7	0.0	11.2	400.2	16.3	220.2	22.
1991	298.3	0.4	150.5	1172.9	0.0	364.6	457.5	21.1	79.3	21.
1992	71.2	4.9	10.0	154.4	0.0	0.6	2.2	9.5	19.8	11.
1993	136.1	3.9	0.0	53.9	0.2	33.5	26.1	0.0	345.8	0.
1994	337.0	390.7	43.7	895.3	0.0	0.1	32.4	1.7	4.3	0.
1995	276.5	52.2	3.2	517.3	0.0	7.1	372.6	16.4	3.1	0.
1996	146.6	215.4	10.9	793.0	2.8	0.5	112.7	3.7	52.2	1.
1997	409.3	211.9	18.3	556.4	0.0	23.4	438.7	25.8	28.2	24.
1998	149.2	89.7	7.7	351.7	0.0	7.3	70.1	2.6	6.3	4.
1999	258.2	156.1	44.9	624.0	0.0	15.3	214.1	0.0	17.1	5.
2000	364.3	166.0	2.5	857.2	0.0	9.8	31.2	0.3	1.4	15.
2001	287.3	223.6	7.2	885.2	0.0	17.5	77.8	12.6	22.1	2.
2002	386.6	65.0	1.9	728.3	3.0	0.0	95.9	2.5	2.2	0.

Source: MRFSS.

Table 13. Recreational landings (pounds) of Atlantic mackerel by mode, 1981-2002.

Year	Shore	Party / Charter	Private / Rental
1981	27,072	5,558,341	1,491,302
1982	243,103	1,063,118	1,318,763
1983	82,102	5,833,502	702,317
1984	114,807	2,659,114	2,339,182
1985	123,087	4,184,595	1,673,902
1986	119,234	3,702,247	5,489,359
1987	180,588	2,763,642	5,944,386
1988	173,079	1,013,699	6,010,771
1989	404,414	1,438,032	2,096,378
1990	217,594	1,290,037	2,608,176
1991	191,743	1,383,457	4,081,506
1992	127,267	92,274	406,418
1993	187,953	161,110	972,663
1994	528,577	927,253	2,303,719
1995	330,454	923,154	1,500,303
1996	353,111	511,685	2,090,183
1997	662,304	1,458,065	1,708,164
1998	146,469	241,322	1,132,294
1999	192,221	645,648	2,105,503
2000	279,945	179,294	2,732,591
2001	179,869	361,581	2,844,174
2002	216,606	50,587	2,566,763

Source: MRFSS

Table 14. NMFS statistical areas where 1%or more of Atlantic mackerel commercial landings occurred in 2002.

Statistical Area	Landings (mt)	Percent of Total
613	9,889	39.0%
537	4,910	19.3%
615	3,188	12.6%
539	3,137	12.4%
612	2,927	11.5%
543	406	1.6%
561	311	1.2%
Other	618	2.4%
Total	25,386	100.0%

Source: Vessel trip report data.

Table 15. Landings of *Loligo pealei* landings by state in 2002.

State	Landings (mt)	Percent of Total
RI	8,227	50.5%
NY	4,374	26.9%
NJ	2,093	12.9%
MA	1,066	6.5%
CT	368	2.3%
VA	108	0.7%
NC	35	0.2%
MD	9	0.1%
ME	1	0.0%
NH	0	0.0%
Total	16,280	100.0%

Source: Unpublished NMFS dealer reports.

Table 16. Landings of *Loligo pealei* by month in 2002.

Month	Landings (mt)	Percent of Total
1	1,520	9.3%
2	1,623	10.0%
3	1,513	9.3%
4	1,483	9.1%
5	1,603	9.8%
6	450	2.8%
7	1,756	10.8%
8	1,799	11.0%
9	333	2.0%
10	2,664	16.4%
11	560	3.4%
12	976	6.0%
Total	16,280	100.0%

Source: Unpublished NMFS dealer reports.

Table 17. Landings of Loligo pealei by gear category in 2002.

Gear Category	Landings (mt)	Percent of Total
TRAWL, OTTER, BOTTOM	16,088	98.8%
POUND NET	105	0.6%
POTS AND TRAPS	38	0.2%
GILL NET	24	0.1%
UNKNOWN	15	0.1%
HOOK AND LINE	9	0.1%
SEINE	1	0.0%
TRAWL, OTTER, MIDWATER	0	0.0%
DREDGE	0	0.0%
Total	16,280	100.0%

Source: Unpublished NMFS dealer reports.

Table 18. Home port state of vessels with Loligo/butterfish moratorium permits in 2002.

Home Port State	No. Vessels	Percent of Total
MA	114	29.9
NY	73	19.2
RI	59	15.5
NJ	43	11.3
NC	29	7.6
VA	17	4.5
CT	6	1.6
ME	8	2.1
PA	10	2.6
MD	2	0.5
DE	1	0.2
FL	2	0.5
UN	17	4.5
Total	381	100.0

Source: Unpublished NMFS permit data.

Table 19. Federally permitted dealers who bought *Loligo* in 2002, by state.

State	Dealers	Percent of Total
NY	44	33.3
RI	25	18.9
MA	24	18.2
NC	19	14.4
NJ	11	8.3
VA	5	3.8
MD	2	1.5
ME	1	0.8
NH	1	0.8
Total	132	100.0

Source: Unpublished NMFS dealer reports and permit data.

Table 20. *Loligo* squid landings by port in 2002.

Port	Landings (mt)	Percent of Total
POINT JUDITH, RI	5,759	35.4%
HAMPTON BAY, NY	2,372	14.6%
MONTAUK, NY	1,659	10.2%
CAPE MAY, NJ	1,263	7.8%
NEWPORT, RI	1,242	7.6%
NORTH KINGSTOWN, RI	1,197	7.4%
NEW BEDFORD, MA	558	3.4%
ELIZABETH, NJ	546	3.4%
FREEPORT, NY	292	1.8%
PT. PLEASANT, NJ	240	1.5%
OTHER BARNSTABLE, MA	191	1.2%
EAST LYME, CT	189	1.2%
NEW LONDON, CT	173	1.1%
Other	600	3.7%
Total	16,280	100.0%

Table 21. Value of landings of all species by port compared to total value of all species landed by port in 2002 where *Loligo* comprised >10% of total value and *Loligo* value for the port is >$25,000.

Port	Vessels	Value All Species	Value Loligo Only	Percent
EAST LYME, CT	4	260,562	260,553	100.0
ELIZABETH, NJ	7	1,086,028	960,087	88.4
FALMOUTH, MA	8	96,801	47,135	48.7
FREEPORT, NY	11	1,018,871	420,855	41.3
HAMPTON BAY, NY	58	7,864,906	3,209,574	40.8
NORTH KINGSTOWN, RI	9	6,411,123	2,100,457	32.8
POINT JUDITH, RI	103	30,892,670	8,176,601	26.5
MONTAUK, NY	40	10,573,105	2,579,548	24.4
NEW LONDON, CT	6	1,638,646	335,674	20.5
NEWPORT, RI	35	7,513,566	1,489,165	19.8

Source: Unpublished NMFS dealer reports.

Table 22. NMFS statistical areas where 1% or more of *Loligo* landings were taken in 2002.

Statistical Area	Landings (mt)	Percent of Total
613	3,324	21.3%
537	2,306	14.8%
616	1,996	12.8%
622	1,455	9.3%
525	1,080	6.9%
612	975	6.3%
562	776	5.0%
166	458	2.9%
075	454	2.9%
626	411	2.6%
539	315	2.0%
611	274	1.8%
526	220	1.4%
615	205	1.3%
632	159	1.0%
538	158	1.0%
Other	1,023	6.6%
Total	15,589	100.0%

Source: Vessel trip report data.

Table 23. Landings of *Illex illecebrosus* by state in 2002.

State	Landings (mt)	Percent of Total
RI	2,388	87.7%
NJ	222	8.2%
VA	94	3.5%
NC	17	0.6%
MA	2	0.1%
ME	0	0.0%
NH	0	0.0%
NY	0	0.0%
MD	0	0.0%
Total	2,723	100.0%

Source: Unpublished NMFS dealer reports.

Table 24. Landings of *Illex illecebrosus* by month in 2002.

Month	Landings (mt)	Percent of Total
1	3	0.1%
2	0	0.0%
3	5	0.2%
4	1	0.0%
5	10	0.4%
6	583	21.4%
7	222	8.2%
8	835	30.7%
9	553	20.3%
10	320	11.8%
11	153	5.6%
12	37	1.4%
Total	2,723	100.0%

Source: Unpublished NMFS dealer reports.

Table 25. Landings of *Illex illecebrosus* by gear type in 2002.

Gear Category	Landings (mt)	Percent of Total
TRAWL, OTTER, BOTTOM	2,722.84	99.9997%
GILL NET	0.01	0.0003%
Total	2,722.85	100.0%

Source: Unpublished NMFS dealer reports.

Table 26. *Illex* squid landings by port in 2002.

Port	Landings (mt)	Percent of Total
NORTH KINGSTOWN, RI	1,936	71.1%
POINT JUDITH, RI	451	16.6%
CAPE MAY, NJ	129	4.8%
ELIZABETH, NJ	93	3.4%
HAMPTON, VA	90	3.3%
Other	25	0.9%
Total	2,723	100.0%

Source: Unpublished NMFS dealer reports.

Table 27. Value of *Illex* squid landings by port compared to total value of all species landed by port in 2002 where Illex comprised >1% of total value and *Illex* value for the port is >$25,000.

Port	Vessels	Value All Species	Value Illex Only	Percent Value
NORTH KINGSTOWN, RI	2	6,411,123	1,033,980	16.1
ELIZABETH, NJ	1	1,086,028	42,741	3.9
POINT JUDITH, RI	9	30,892,670	219,680	0.7
CAPE MAY, NJ	4	26,772,375	60,865	0.2
HAMPTON, VA	2	16,421,022	29,667	0.2

Source: Unpublished NMFS dealer reports.

Table 28. Home port state of vessels with *Illex* moratorium permits in 2002.

Home Port State	No. Vessels	Percent of Total
NJ	15	20.8%
MA	15	20.8%
RI	11	15.3%
NY	8	11.1%
NC	9	12.5%
VA	5	6.9%
PA	5	6.9%
FL	1	1.4%
ME	1	1.4%
UN	1	1.4%
Total	72	100.0%

Source: Unpublished NMFS permit data.

Table 29. Federally permitted dealers who bought Illex squid in 2002, by state.

State	Dealers	Percent of Total
RI	5	26.3%
MA	3	15.8%
NC	3	15.8%
NJ	2	10.5%
VA	2	10.5%
MD	1	5.3%
ME	1	5.3%
NH	1	5.3%
NY	1	5.3%
Total	19	100.0%

Source: Unpublished NMFS dealer reports and permit data.

Table 30. NMFS statistical areas where1% or more of *Illex* squid landings were taken in 2002.

Statistical Area	Landings (mt)	Percent of Total
632	1,102	45.2%
626	790	32.4%
622	334	13.7%
616	77	3.2%
612	40	1.7%
623	40	1.6%
537	39	1.6%
Other	14	0.6%
Total	2,436	100.0%

Source: Vessel trip report data.

Table 31. Landings of butterfish by state in 2002.

State	Landings (mt)	Percent of Total
RI	414	49.2%
NY	240	28.5%
NJ	59	7.0%
CT	44	5.3%
NC	26	3.1%
VA	25	2.9%
MA	24	2.9%
MD	8	0.9%
ME	1	0.1%
NH	0	0.0%
DE	0	0.0%
Total	841	100.0%

Source: Unpublished NMFS dealer reports.

Table 32. Landings of butterfish by month in 2002.

Month	Landings (mt)	Percent of Total
1	57	6.7%
2	99	11.8%
3	90	10.7%
4	79	9.4%
5	151	17.9%
6	69	8.2%
7	41	4.9%
8	39	4.6%
9	73	8.6%
10	48	5.7%
11	50	6.0%
12	46	5.4%
Total	841	100.0%

Source: Unpublished NMFS dealer reports.

Table 33. Landings of butterfish by gear type in 2002.

Gear Category	Landings (mt)	Percent of Total
TRAWL, OTTER, BOTTOM	764.9	98.8%
POUND NET	29.3	0.6%
GILL NET	26.4	0.2%
POTS AND TRAPS	9.2	0.1%
UNKNOWN	7.4	0.1%
HOOK AND LINE	1.8	0.1%
TRAWL, OTTER, MIDWATER	1.7	0.0%
SEINE	0.3	0.0%
Total	841.0	100.0%

Source: Unpublished NMFS dealer reports.

Table 34. Landings of butterfish by port in 2002.

Port	Landings (mt)	Percent of Total
POINT JUDITH, RI	330	39.3%
MONTAUK, NY	125	14.9%
HAMPTON BAY, NY	62	7.4%
NEWPORT, RI	50	5.9%
NEW LONDON, CT	44	5.3%
CAPE MAY, NJ	42	5.0%
NORTH KINGSTOWN, RI	27	3.2%
AMMAGANSETT, NY	17	2.0%
GREENPORT, NY	16	1.9%
NEW BEDFORD, MA	13	1.6%
WANCHESE, NC	13	1.5%
MATTITUCK, NY	10	1.2%
Other	92	10.9%
Total	841	100.0%

Source: Unpublished NMFS dealer reports.

Table 35. Value of butterfish landings by port compared to total value of all species landed by port in 2002 where butterfish comprised >1% of total value and butterfish value for the port is >$25,000.

Port	Vessels	Value All Species	Value Butterfish Only	Percent Value
GREENPORT, NY	10	519,694	30,298	5.8
AMMAGANSETT, NY	6	484,806	28,105	5.8
NEW LONDON, CT	6	1,638,646	45,075	2.8
MONTAUK, NY	37	10,573,105	172,915	1.6
POINT JUDITH, RI	96	30,892,670	327,897	1.1
HAMPTON BAY, NY	50	7,864,906	81,065	1.0

Source: Unpublished NMFS dealer reports.

Table 36. Federally permitted dealers who bought butterfish in 2002, by state.

State	Dealers	Percent of Total
NY	36	32.1%
RI	23	20.5%
NC	18	16.1%
MA	13	11.6%
NJ	11	9.8%
VA	5	4.5%
MD	2	1.8%
ME	2	1.8%
CT	1	0.9%
NH	1	0.9%
Total	112	100.0%

Source: Unpublished NMFS dealer reports and permit data.

Table 37. Loligo/butterfish moratorium vessel permit holders in 2002 by home port state.

Home Port State	No. Vessels	Percent of Total
MA	114	29.9
NY	73	19.2
RI	59	15.5
NJ	43	11.3
NC	29	7.6
VA	17	4.5
CT	6	1.6
ME	8	2.1
PA	10	2.6
MD	2	0.5
DE	1	0.2
FL	2	0.5
UN	17	4.5
Total	381	100.0

Source: Unpublished NMFS permit data.

Table 38. NMFS statistical areas from where1% or more of butterfish landings were taken in 2002.

Statistical Area	Landings (mt)	Percent of Total
537	154	20.3%
525	77	10.1%
526	76	10.0%
613	75	9.9%
616	68	9.0%
539	51	6.8%
611	37	4.9%
621	34	4.5%
625	31	4.1%
148	20	2.7%
562	19	2.5%
623	18	2.3%
144	13	1.7%
635	13	1.7%
612	10	1.3%
167	8	1.0%
Other	56	7.4%
Total	759	100.0%

Source: Vessel trip report data.

Table 39. Summary of impacts of proposed and alternative specifications for 2004 for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish.

Species	Alternative	Total No. Vessels	Total Revenue Change ($ millions)	Revenue Change/ Vessel ($)	No. Vessels w/ Revenue Reduced by > 5%
A. mackerel	Alt. 1	408	0	0	0
A. mackerel	Alt. 2	408	0	0	0
A. mackerel	Alt. 3	408	0	0	0
Loligo	Alt. 1	426	0	0	0
Loligo	Alt. 2	426	0	0	0
Loligo	Alt. 3	426	-4.63	-10,876	110
Illex	Alt. 1	36	0	0	0
Illex	Alt. 2	36	0	0	0
Illex	Alt. 3	36	0	0	0
butterfish	Alt. 1	453	0	0	0
butterfish	Alt. 2	453	0	0	0
butterfish	Alt. 3	453	0	0	0

Table 40. Comparison of the size distribution of all vessels which landed *Loligo* in 2002 and those expected to have total gross revenues reduced by >5% as a result of the alternative 3 quota (13,000 mt) for *Loligo* in 2004.

	Vessels that Landed *Loligo* in 2002		Affected Vessels[1]	
Length (ft)	# Vessels	% Vessels	# Vessels	% Vessels
25 - 49	100	24.1	24	22.1
50 - 74	216	51.9	50	45.8
75 - 99	94	22.6	31	28.4
100 - 138	6	1.4	4	3.7
Total	416	100	109	100
Ton Class	# Vessels	% Vessels	# Vessels	% Vessels
1	1	0.2	0	0.0
2	145	34.8	32	29.4
3	218	52.4	55	50.5
4	52	12.5	22	20.3
Total	416	100	109	100

[1] Vessels with revenues reduced by >5%.
[2] TC 1= <5 GRT; TC 2= 5 - 50 GRT; TC 3= 51 - 150- GRT; TC 4= >150 GRT.

Source: Unpublished NMFS permit file data.

Table 41. Distribution of vessels by home port state which landed *Loligo* in 2002 v. those affected by the alternative 1 quota of 13,000 mt and alternative 3 quota of 13,000 mt for *Loligo* in 2004.

	All Vessels Landing *Loligo* in 2001		Alternative 3 Quota (13,000 mt)	
Home Port State	# Vessels	% Vessels	# Vessels	% Vessels
MA	97	23.3	20	18.4
MD	7	1.7	0	0.0
NC	61	14.7	0	0.0
NJ	46	11.1	6	5.5
NY	84	20.2	46	42.2
PA	2	0.5	0	0.0
RI	90	21.6	34	31.2
VA	17	4.1	0	0.0
Other	12	2.8	2	1.8
Total	416	100.0	109	100.0

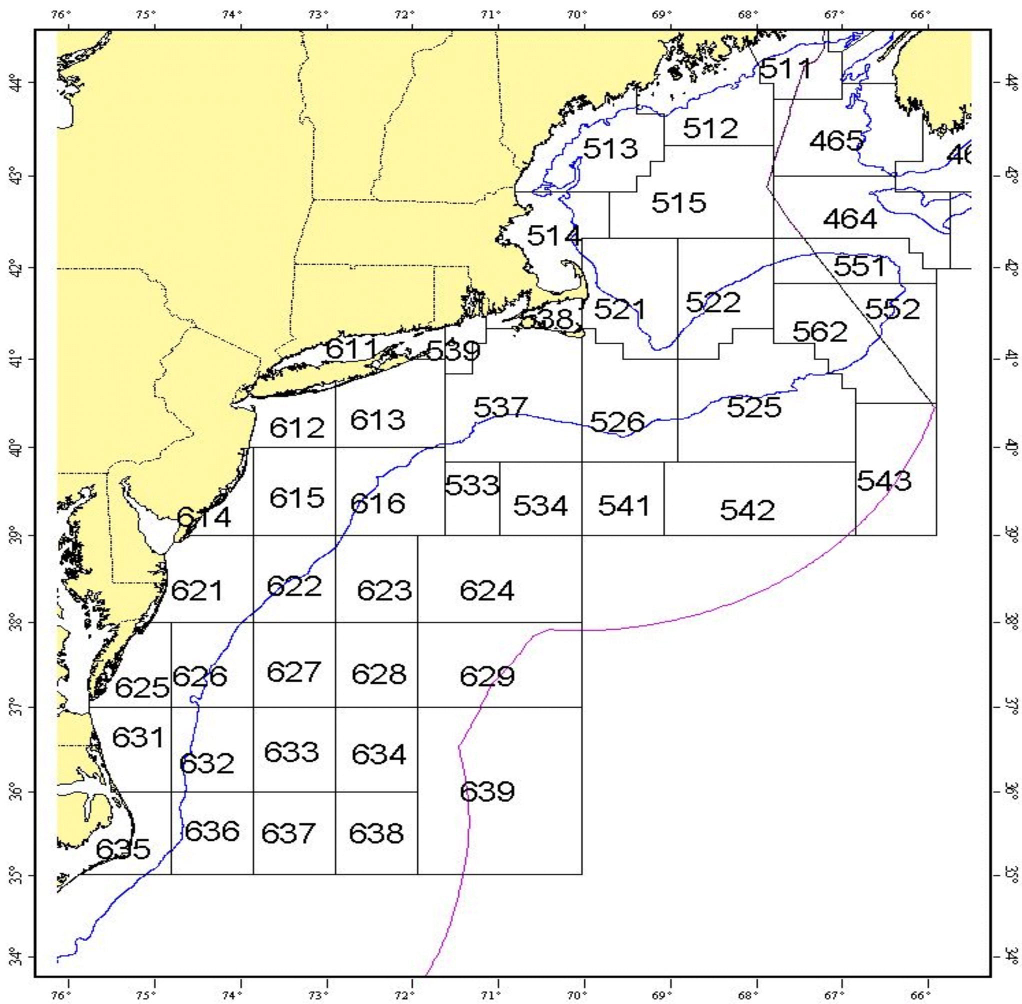
Source: Unpublished NMFS permit file data.

Table 42. Distribution of vessels by principal port landing state which landed *Loligo* in 2002 v. those vessels affected by the alternative 1 quota of 13,000 mt for *Loligo* in 2004.

	All Vessels Landing *Loligo* in 2002		Alternative 3 Quota (13,000 mt)	
Principal Port State	# Vessels	% Vessels	# Vessels	% Vessels
CT	6	1.4	3	2.7
MA	83	19.9	16	14.7
MD	8	1.9	0	0.0
ME	5	1.2	1	0.0
NC	61	14.7	0	0.0
NJ	51	12.3	7	6.4
NY	77	18.5	43	39.4
RI	106	25.5	39	35.8
VA	18	4.3	0	0.0
Total	416	100	109	100.0

Source: Unpublished NMFS permit file data.

Figure 1. NMFS Northeast Statistical Areas.



Appendix 1

Port and Community Profiles for the Atlantic Mackerel, Squid and Butterfish Fisheries

The following port and community profiles were excerpted from a report prepared for the Mid-Atlantic Council and submitted by Bonnie J. McCay on behalf of The Fisheries Project, Rutgers University, with the assistance of Kevin St. Martin, Brent Stoffle, Bryan Oles, Eleanor Bochenek, Teresa Johnson, Johnelle Lamarque, Giovani Graziosi, Barbara Jones, Judie Hope, and Kate Albert. The correct citation for this report is given under McCay *et al.* 2002 in the references listed above.

“ According to the Sustainable Fisheries Act of 1996, "[t]he term "fishing community" means a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community." Guidelines to the SFA indicate that by community is meant a recognized place, such as a village, town, or city. For the purposes of this social impact assessment, community is defined as a fishing port or a place where fish (and squid) are processed, although it is recognized that people involved in the fisheries may live and work elsewhere and that there are important social networks and cultural identities that transcend municipal boundaries.

Communities from Rhode Island to North Carolina are involved in the harvesting and processing of Loligo and Illex squid, Atlantic mackerel, and butterfish. The communities chosen for the profiles that follow are those with the greatest participation and dependency on the four species in the year 2000 (see Table 1).

Table 1: Major Fishing Ports, Squid, Atlantic Mackerel, and Butterfish (SMB) Fisheries, as Ranked by Total Value of Fish Landings, Value of SMB Landings, and Percent SMB Landings to Total Landings, 2000

PORT	STATE	COUNTY	Rank:Total Value	Rank: SMB Value	Rank SMB/Total %
New Bedford	MA	Bristol	1	9	12
Point Judith	RI	Washington	2	1	8
No. Kingstown	RI	Washington	7	2	2
Newport	RI	Newport	8	6	9
Stonington	CT	New London	9	11	10
Montauk	NY	Suffolk	5	5	6
Hampton Bays/ Shinnecock	NY	Suffolk	6	4	4
Greenport	NY	Suffolk	11	12	5
Freeport	NY	Nassau	10	7	3
Elizabeth	NJ	Union	12	10	1
Point Pleas-ant	NJ	Ocean	4	8	11
Cape May	NJ	Cape May	3	3	2

Source: National Marine Fisheries Service Weighout Data, 2000.

Profiles are provided for the ports listed in Table 1 as well as for Shinnecock, NY, Brooklyn, NY, Newark, NJ, Hampton, VA, and Wanchese, NC , which are included in the study because of their engagement in one or more of the SMB fisheries. Numerous other ports are involved in the squid, mackerel, and butterfish fisheries but at a lower level of participation and/or dependence; information on most of the major fishing communities of New England and the Mid-Atlantic regions can be found in "New England's Fishing Communities" (Hall-Arber et al. 2002) and "Fishing Ports of the Mid-Atlantic" (McCay and Cieri, 2000), both of which have contributed to these profiles, supplemented by more recent research.

The following profiles are organized from north to south, from Massachusetts to North Carolina; in most cases the county in which a port or other community is found is also briefly described, as an indicator of the larger socio-economic system.

Bristol County and New Bedford, Massachusetts

Bristol County, MA

According to the 2000 Census, Bristol County had a population of 534,678 (Table MA-RI). This was a 5.6% increase from 1990. Ninety-one percent of the county population was white and of the total population 24.6% were under 18 years of age and 14.1% were 65 years of age or over.

In 1999, Bristol had a per capita income of $27,461. Based on a 1997 model based estimate, 11.9% were living below the poverty level. In 2000, the unemployment rate was 3.9% and seasonally the rate ranged from a high of7.2% to a low of 3.9%. In 1990, of those 16 years of age or older, 1.5% of the total number employed were engaged in the agriculture, forestry, and fisheries industry.

New Bedford, MA

New Bedford's census profile is that of a struggling, impoverished industrial city. According to the 2000 Census, New Bedford had a population of 93,768, a 6.2% decrease from 1990 (Table MA-RI). Seventeen percent of the population was minority, primarily Hispanic, and the median age was only 35.9 years. In 1990, New Bedford had a per capita income of $10,923 and of the total population 16.8% were classified as living below the poverty level. In 1990, the unemployment rate was 12.2%.

Of those 16 years of age or older, only 1.3% of the total number employed were engaged in the agriculture, forestry, and fisheries industry in 1990, suggesting that the fisheries are marginal to the community. However, more extensive research shows that between 5 and 8 percent of the people in the New Bedford metropolitan statistical area receive their livelihoods primarily from fishing. Even a conservative estimate, assuming two other individuals are supported by each fisherman and fishing-related worker employed, places the proportion of the population dependent on fishing between 11 and 18% (Hall-Arber et al. 2002).

Fisheries Infrastructure

New Bedford is a major deep-water port with a long history of commercial fishing (Hall-Arber et al. 2002). Fishing and allied industries still contribute one-fifth of the city's income. New Bedford remains one of the three premier fishing ports in New England and it is consistently numbered among the top U.S. ports for the value of its commercial fishery landings, number 1 in the year 2000. Its highly differentiated fishing infrastructure was developed early in its history and has continued to grow (Hall-Arber et al. 2002).

Of all major groundfishing ports in the eastern U.S., New Bedford and environs, including neighboring Fairhaven, has the most developed infrastructure for fishing, together with Portland, Maine and Chatham, MA (Hall-Arber et al. 2002). It has the most total capital invested in the fishing industry and the largest fleet of any port. According to one report (Hall-Arber et al. 2002), in the late 1990s there were a total of 1,131 crew manning 265 vessels. Of these, 82 are scallopers, typically with 7 member crews, and 183 were draggers with average crew size of four. In 2000 there were also 9 large ocean quahog vessels. There are also smaller lobstering and gill-net boats.

Estimates of the numbers of fishermen vary. Crew sizes on scallop and groundfish vessels have diminished in the past few years, partly due to regulations (e.g., scallop boats are restricted to 7 crewmembers). Consultants in a 1999 harbor planning process identified 2,600 jobs and $609 million in sales directly attributable to the core seafood industry. Another 500 jobs were indirectly related, as was about $44 million in sales (Hall-Arber et al. 2002.).

In addition to boat owners, captains, and crew, the full New Bedford/ Fairhaven fleet (neighboring Fairhaven is the home of many of the vessels) generates business for around 75 seafood processors and wholesale fish dealers and 200 other shoreside industries. Together, these businesses provide employment for around 6,000 to 8,000 additional workers (Hall-Arber et al. 2002).

Squid, Atlantic Mackerel, and Butterfish

New Bedford ranks 9th in terms of the value of squid, Atlantic mackerel, and butterfish landings, and 12th in terms of the proportion of total landings from these species (Table 1). They are part of a large suite of species caught by the draggers of New Bedford. The fishing grounds used are generally northeast of the areas considered as Essential Fish Habitat in this amendment to the FMP, with the consequence that there are few if any direct impacts of potential closures of EFH areas in the Mid-Atlantic, although this may change as groundfish regulations are stricter and more stringently applied. This port was not visited for the SIA but discussions with people in the industry indicate that there is currently little or no processing of these species in New Bedford; most facilities are just packing them. The 2000 weighout data indicate that 64 boats landed Loligo squid, 15% of the total boats landing in New Bedford that year.

Rhode Island's Fishing Ports and Communities

The following Rhode Island ports were determined to have a significant dependence on the species included in the FMP based on the value of the four species as a percent of the total value of all landings in the 2000 weigh-out data: North Kingstown, Point Judith, and Newport (Table 1). Newport and Point Judith, each having sizeable numbers of seagoing vessels, are located in the lower part of Narragansett Bay, as is North Kingstown, where there is an area called Quonset Point that hosts seafood processing and freezer trawlers.

Census data for 1990 and 2000 as well as other data are presented in Table MA-RI for the census units and counties. Newport is in Newport County, which has a total population of 85,433, in 2000, a 2% decline from 1990; Newport itself numbered 26,475 in 2000, a 6.2% decline. Newport has a sizeable minority population, primarily Black/African American (7.8%) and Hispanic (5.5%), a low median age (34.9 years) and high percentage of people living in poverty, based on a 1997 model (12.5%).

North Kingstown and Point Judith are in Washington County, population 123,546 in 2000, a 12.3% increase from 1990. North Kingstown's population was 26,326 in 2000, a 10.7% increase, and Point Judith's population (Narragansett census tract) was 16,361 in 2000, a 9.2% increase. These places have relatively small minority populations (Table MA-RI).

Newport and Point Judith were studied extensively by Hall-Arber et al. (2002). Newport is far less dependent on fishing than Point Judith is, based on fishing infrastructure and alternative activities. Point Judith ranked fifth and Newport 13th out of 36 New England ports in terms of fishing infrastructure differentiation (Hall-Arber et al. 2002: 39-40). However, they also ranked near the top of a scale of gentrification, Point Judith ranking 7 and Newport 5 out of 36 (Hall-Arber et al. 2002: 44). Rhode Island fishing communities are among the most "gentrified" in New England, many with long histories of tourism focusing on water sports, sailing, and summer "cottages." One consequence is that dockage (and other waterfront amenities) has become a problem in Newport and Point Judith due to competition for waterfront land and space, including areas for parking and gear. In Newport, commercial fishing activities have moved away from the tourist center, but they continue to be pressured to move farther away, competing with a highly active tourist trade and recreational boating sector (Hall-Arber et al. 2002: 45).

Point Judith remains one of the top fishing ports in the U.S. on the basis of quantity and value of landings. It is the most fisheries-dependent of Rhode Island's communities, with about 500 households directly involved in and another 400 indirectly dependent on the commercial fisheries (Hall-Arber et al. 2002: 80). Point Judith "fulfills the definition of a fishing community on the basis of central place theory. Fish are legally sold ex-vessel to a dealer, processor o r the public; fishing support services are provided; there are public facilities providing dockage; fishing people satisfy their daily and weekly social and/or economic needs here, and some fishermen and their representatives participate in fisheries resource management" (Hall-Arber et al. 2002: 78). In addition, "Despite changes," as one respondent put it, "there is still a distinct community of fishermen here." Fishermen comprise a social and occupational network: "People know each other." The small town atmosphere is punctuated by functions such as the Fishermen's Scholarship Fund's annual game feast where $6,000 was recently raised for the sons and daughters of fishermen" (Hall-Arber et al. 2002: 78).

The Blessing of the Fleet has become largely an activity of the recreational fishing community. There is little ethnic diversity in the fishing population, and many are relatively newcomers to fishing. Fishermen tend to live in small local communities of southern Rhode Island, within a 20-mile radius of the port; there is little residential housing near the port. The majority of the fish processing workers are ethnic minorities, often bussed in from the city of Providence, RI. There are numerous fisheries organizations in Point Judith (some serving the entire state) and fishing-related programs and services (Hall-Arber 2002: 83-84).

Newport, RI, has a long history of tourism and recreational boating, which started in the 1700s, but also a long and persistent engagement in commercial fishing historically based on floating fish traps but today divided between lobstering and a fleet of draggers and scallopers. Approximately 200 families are involved in the fisheries of Newport. The groundfish fleet has dramatically declined over the last 20 years, spurred by increasing property values that have restricted access to waterfront and other property, and the fisheries are minor compared with other economic and social activities (Hall-Arber 2002: 93-100). However, Newport remains a sizeable port. In 2000 90 boats landed fish and shellfish at Newport, according to the weighout data. There is no processing of squid, mackerel, or butterfish in Newport. The cultural importance of fishing to the community is evidenced in the museum at the Fishermen's Church Institute. Recreational fishing is mostly rod and reel fishing from shore for stripers.

North Kingstown is a large township with nine villages, one of which is maintained as a historic district (Wickford) (www.northkingstown.org, www.northkingstown.com). There is a charter boat company and about six marine-related businesses including marine repair, a mooring service, and a marina. The commercial fisheries are mainly found in the Quonset Point area, which was the site of a U.S. Naval Air Station, now a state airport, and a large industrial park, the Quonset Davisville Port and Commerce Park, the contested focus of plans for economic development including a container port (see www.sierraclubri.org/quonset).

Squid, Atlantic Mackerel, and Butterfish

Squid and butterfish have long been primary targets of fishermen from this area, together with whiting and scup--the diversified "small mesh" fishery of the Mid-Atlantic--and with the decline of groundfish in the northeast, these species have become even more important. According to the 2000 weigh-out data, 90 boats landed *Loligo* in Point Judith, or about 40% of all the boats that landed fish in Point Judith that year. Forty-two boats (47%) landed *Loligo* in Newport, and for North Kingstown, 7 boats landed *Loligo* in 2000, 20% of all the boats that year. Newport, North Kingstown and Pt. Judith land high volumes of *Illex*, *Loligo*, mackerel and butterfish, especially as groundfish landings in the area have declined. Loligo accounted for between 12 and 16% of the value of total landings in Point Judith, Newport and North Kingstown in 2000. Butterfish played a very small role in Point Judith and Newport, less than 2% of the total landings value, but in North Kingstown butterfish accounted for over 17% of the total value of landings.

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

Most fish processing in Pt. Judith is done in a large industrial area, the location of six processing plants, including Town Dock, the former Point Judith Cooperative (now the Pt. Judith Fishermen's Company), South Pier Fish, and Sea Fresh Corporation (Hall-Arber et al. 2002: 79). In recent years the processors have shifted their focus away from groundfish (fluke, yellowtail flounder, cod, whiting, and other species) and toward squid, herring, and mackerel (Ibid). A processor from Pt.

Judith interviewed in 2002 noted that their busy season is during the winter and slow season is in the summer with *Loligo* being his primary product for processing. He used to process a lot of butterfish, but because of the down turn in the Japanese market, there is less demand for butterfish. He derives 50% of his revenue from *Loligo*. He buys product from 20-22 boats. Most of the boats have landed at his dock for many years; only a few move around to other docks. Another Pt. Judith processor indicated that *Loligo* and butterfish are important to his business, but not *Illex* and mackerel. If he could obtain more volume of butterfish he could sell it. Thirteen boats land at his facility. He has bought product from the same boats for 20 years.

Connecticut's Fishing Ports and Communities

Connecticut's coast has been transformed by the expansion of metropolitan populations. "Most fishermen in Connecticut are embedded as fishing 'clusters' within their communities, and as such do not make up a significant economic component of local economies. The decline in the fishery is directly related to the loss of fishing community as a definite space and place dominated by a population sharing traditions of fishing. Nevertheless, fishing persists as enclaves,.... The historic loss of the core fishing population has proceeded simultaneously with an intense gentrification process that has converted fishing neighborhoods and dock space into expensive tourist weekend and summer homes surrounded by gentrified shops, restaurants, and marinas" (Hall-Arber et al. 2002: 52).

East Haven and Stonington, CT

East Haven numbered 28, 189 in 2000, a 7% increase from 1990 (Table CT). It is within New Haven County, and differs from it in having a much smaller minority population but also lower per capita incomes. The percent of those aged 16 and older employed in agriculture, forestry, and fisheries was only 0.3% in 1990. The importance of coastal tourism is indicated by the fact that of the vacant housing units, 30% have seasonal, recreational, or occasional uses.

Only Stonington persists as a port with an established and distinct dock space for fisheries, "the home port of Connecticut's last remaining commercial fishing fleet" (www.stonington.ct/harborplan.html). Stonington itself is a large township, made up of the Borough of Stonington and the villages of Mystic, Old Mystic, Pawcatuck, and Wequetequock. Stonington's population was 17,906 in 2000, a 6% increase from 1990. It has a very small minority population, and a relatively high median age, 41.7 years (Table CT). The per capita income was higher than that of New London County.

Tourism is the major emphasis for development of the Stoninigton area, building on the proven popularity of Old Mystic and the Mystic Aquarium (www.munic.state.ct.us/Stonington). The fishing community is an enclave within one borough, and its ties to the town and borough are not very strong. For example, no fishermen now live on the main street of Stonington, which consists of gift shops and fashionable year round and summer residences. However, the commercial fleet survives in part because of political support from the town, which has reserved the Town Dock for commercial operations (www.stonington.ct/harborplan.html). In other Connecticut ports, fishing boats must compete with recreational marinas and dockside tourist facilities as well as rising property values (Hall-Arber et al. 2002: 51). In Stonington there appears to be strong recognition of the economic and symbolic value of the commercial fisheries.

Stonington's fishing fleet is split between day boats and offshore draggers; the latter target scallops, squid, fluke, butterfish, shrimp, monkfish, and whiting (Hall-Arber et al. 2002: 56). Lobstering is important (although affected by the lobster disease problems of Long Island Sound), and conch has emerged as a niche fishery here as in other ports of the region. The commercial dock, the Town Dock, is maintained under a lease from the town and is reserved for fishing-related activities. Two packing houses handle fish and shellfish, and the Southern New England Fishermen and Lobstermen Association (SNEFLA) helps lower costs of ice, fuel, gear, and supplies (Hall-Arber et al. 2002: 57). Members of SNEFLA are from Connecticut, Rhode Island,

and Massachusetts; it began in 1931 to help with common problems such as the hijacking of trucked shipments of fish to the urban markets (Hall-Arber et al. 2002: 58). Members are allotted tie-up space at the Stonington Pier and have attempted to join the fishermen's health care plan initiated by the Massachusetts Fishermen's Partnership. Stonington ranked fairly high in terms of fishing infrastructure differentiation (10 out of 36), which includes the presence oor absence of icehouses, boat insurance, dockside diesel fuel, local trucking, a fishermen's supply house, monuments, and so forth (Hall-Arber et al. 2002: 38-39). Surprisingly, it ranked fairly low in the gentrification ranking of New England ports, 20 out or 36 (Ibid: 44). Comparable information is not available for East Haven.

There are very few fishermen living in the central part of Stonington, the historic "village" or Borough, but the Portuguese Holy Ghost Society and the Feast of the Holy Ghost persist as a social nexus, through the church, even though few Portuguese speakers are now in the fisheries.. The Portuguese first came to Stonington industry from the Azores or Cape Verde Islands in the 1700s as participants in the sealing and whaling, and Portuguese ethnicity remains associated with Stonington (Hall-Arber et al. 2002). The SNEFLA hosts an annual Blessing of the Fleet after a requiem mass for fishermen who lost their lives at sea:

"St. Mary's Church is home to a tall pastel statue of St. Peter, the patron saint of fishermen. Every July the statue makes its way in a parade from St. Mary's Church down Water Street to the docks and up Main Street to the Holy Ghost Hall. The parade is a somewhat solemn occasion. It follows a requiem mass in honor of the fishermen who have lost their lives at sea. A pickup truck drags a decorated dory in back of it. The truck is followed by a car carrying several grieving widows of local fishermen. The wives are in mourning and are dressed in black, respectfully indicating their loss to the solemn-faced spectators who are watching the truck pass. The fishing draggers moored at the Stonington dock are loaded with visitors and passengers and then the procession of draggers heads out to the inner breakwater. The bishop rides on the first fishing boat along with the fisherman's widow. As the draggers pass the first fishing boat, the bishop blesses each boat with holy water and prayers are said requesting a safe and prosperous fishing season. The draggers then form a circle so all can view the honored widow as she throws the wreath over-board in honor of those fishermen who have lost their lives at sea."
(Www.clemclay.com/thevillage.index.html).

Squid, Atlantic Mackerel, and Butterfish

The ports of East Haven and Stonington, CT, have small commercial fisheries that are engaged in fishing for the species of this FMP. For example, eleven out of the 17 boats in East Haven landed butterfish in 2000, and this species accounted for almost 5% of the total value in the port. Its landings of butterfish were roughly comparable in value to those of Point Pleasant, NJ, Freeport, NY, and Newport, RI. East Haven and Stonington also saw landings of *Illex* squid, at a low level but ranking 7th and 8th of the top 10. Stonington's catches of *Loligo* squid brought it into the top 10 for Loligo, comparable to the landings of Point Pleasant, NJ, in 2000.

New York's Fishing Ports and Communities

New York fishing ports, like those of Rhode Island and northern New Jersey, are on the boundary of the New England and the Mid-Atlantic ecological and institutional systems, and the diversity of species as well as fisheries agencies and laws involved is very high. In addition, the fisheries have a premium on adaptability, because of changes in the distribution and abundance of different species as well as market changes. Commercial fishing ports in New York State are concentrated on Long Island, which extends from Brooklyn, a borough of New York City, to the far eastern ports of Montauk (on the South Fork) and Greenport (on the North Fork). There are also small, but historically and culturally important, fisheries for migratory species on the Hudson River and other rivers (McCay and Cieri 2000).

New York's commercial fisheries are difficult to characterize in relation to NMFS weigh-out data and other information because they are quite widely dispersed. There are many well-known ports but large quantities of fish and shellfish are landed elsewhere. In addition, state waters (to 3 nautical miles) are extremely important. New York State's data on those fisheries do not include NMFS port codes. Consequently, the category "Other New York" in the NMFS weigh-out data is very large, accounting for 35% of the value and 23% of the pounds landed in 1998. Many of the fisheries of Long Island and Long Island Sound, particularly for lobsters, are represented in this category and not assigned to particular ports. The category also includes surf clamming and other fisheries that take place exclusively in state waters (McCay and Cieri 2000).

Of the four species included in the FMP, *Loligo* or long-finned squid figures most prominently in weigh-out data for the fishing ports on Long Island, followed by butterfish. *Loligo* accounted for 12% of the total value of commercial landings, as reported in weigh-out data for the year 2000. Butterfish accounted for 1% of the total value. Atlantic mackerel and *Illex*, or short-finned squid, accounted for less than 1% of the total value of fish landed in New York in 2000.

The following ports were determined to have a significant dependence on the species included in the FMP based on the value of the four species as a percent of the total value of all landings in the 2000 weigh-out data: Brooklyn, Freeport, Greenport, Hampton Bays, and Montauk. The value of the four species in each of these ports was between 20% and 50% of the total catch value in each port. Visits were made to each of these ports and interviews were conducted with fishermen, dock personnel, processing plant managers, and community representatives. Additional information for the following port profiles is derived from "Fishing Ports of the Mid-Atlantic" (McCay and Cieri 2000).

Suffolk County, NY

Suffolk County is the eastern half of Long Island and encompasses major fishing ports that include Hampton Bays/Shinnecock, Montauk, and Greenport, as well as numerous smaller ports that were not included in this analysis. The fisheries of Suffolk County are highly diverse and also highly dispersed, such that much of what is landed is recorded as "other" rather than assigned to a specific port. Although Suffolk County is being rapidly developed, it produces the largest agricultural revenue of the counties in New York. Table (NY) presents 1990 and 2000 census data for the county and the county's ports that are included in this analysis.

Montauk, NY

Montauk, the largest fishing port in New York, is situated near the eastern tip of the South Fork of Long Island. A sign near the bay front marinas and docks welcomes visitors to Montauk: "The Fishing Capital of the World". The region's economy is heavily dependent on commercial and recreational fishing. Many of the local businesses provide services to the fishing industry. One informant estimated that there are approximately 300 fishing families in the area. According to the 1990 U.S. Census, there were approximately 290 residents who reported "fishing" as their occupation. Also of note is the 14.02% increase in the number of Hispanic residents since 1990 (Table NY). A large number of the dock workers in Montauk are Hispanic. Seasonal tourism is also extremely important to the local economy. The median house value in 1990 was $238,600, reflecting the high cost of housing in the vicinity. Informants working in the fishing industry who were interviewed for this study cite high housing costs as a challenge.

Fishing Infrastructure

The commercial fishing docks in Montauk are clustered at the northern end of the South Fork,in Montauk Harbor. Commercial dock space is limited in the area. Commercial fishing boats are docked in three primary locations, including a town dock next to the Coast Guard

Station on the East side of the harbor, another town dock located near one of the packing businesses and the fish markets on the West side of the harbor, and a packing business located near the East side of the harbor's inlet. There are two primary businesses that pack commercial landings and a third that buys small quantities for both its retail market and for wholesale to restaurants. According to an informant at one of the docks, a packing business that used to operate recently moved out of the commercial packing business and now caters to recreational fishermen. In addition to the commercial docks in Montauk Harbor, there are a number of marinas dedicated to recreational fishing boats and pleasure craft. Numerous party and charter boats in Montauk Harbor cater to tourists and seasonal visitors.

Fishing Overview

According to NMFS weigh-out data for 1998, otter-trawls accounted for 80% of the pounds landed and 60% of the value in Montauk. *Loligo* squid (20% of the value) and silver hake (16% of the value) were the two most important finfish caught in 1998. Butterfish accounted for 2% of the value, and small amounts of *Illex* and Atlantic mackerel were also reported. Bottom longlining is traditionally important in Montauk. It accounted for 21% of the value in 1998, mainly derived from tilefish, swordfish and tunas. Montauk is the leading tilefish port in the U.S., but this fishery has declined greatly. In 1998 and 1999 some of the Montauk-based tilefish boats landed their catches in Rhode Island. Nonetheless, tilefish accounted for 21% of the value of landings in this port in 1998. There were 90 species landed at Montauk. 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 (McCay and Cieri 2000).

Squid, Atlantic Mackerel, and Butterfish

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

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

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

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

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

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

Fishing Community/Relations

Informants note that Montauk has a rich historical connection to commercial fishing that is very important to the village's identity. The manager of one of the commercial packing docks is also a member of the East Hampton Town Board's Fishing Committee. This committee represents the interests of those who are dependent on the fishing industry of the area for the development of the new Comprehensive Plan. The Fishing Committee recently reported to the board that commercial fishing contributes an estimated 34 million dollars ex-vessel to the town, 90% of which comes from Montauk. The East Hampton Comprehensive Plan, which is set to be ratified in the coming year, acknowledges that, "fishing is East Hampton's largest and most historically significant industry." The committee has submitted a number of recommendations for inclusion in the Comprehensive Plan that promote and encourage the development of businesses that are critical for the support of commercial fishing. In general, the municipal government has been supportive of the fishing industry. However, informants note that local ordinances and zoning laws make expansion of commercial fishing areas difficult (McCay and Cieri 2000).

Other fishermen interviewed for the study indicated that Montauk has few multigenerational fishing families. Most of the commercial fishermen in Montauk are first generation who moved into the area from other coastal towns on Long Island. One fisherman contrasted the single generation fishermen of Montauk with the multigenerational families of baymen in neighboring Amagansett. While there are few multigenerational fishing families in Montauk, there are many fishing families in Montauk. One informant in the industry estimated that there are at least 300 fishing families in the region. In addition, the fishermen and industry representatives who were interviewed expressed a very strong sense of solidarity and pride in their community. They also expressed an awareness of how dependent the local society and economy is on fishing. One fisherman cited a NOAA-funded study on the region reporting that the community of Montauk is highly dependent on commercial fishing. Another fisherman pointed out the businesses that rely on his fishing operation. He and his crew spend approximately $40,000 each year at the local supermarket for supplying the voyages, and at least $2000 per week on ice alone. In addition, there are a host of ancillary businesses across the state and across the country that depend on the fishing industry of Montauk.

Shinnecock/Hampton Bays, NY

Shinnecock/Hampton Bays is the second most important commercial port in New York in terms of the value of total landings. Hampton Bays is located at the western end of the South Fork on the Southern shore of Long Island. It is located just between East Quogue to the west and Southampton Village and Shinnecock Hills on the east. Its boundary extends to Great Peconic Bay on the north, and to the Atlantic Ocean on the south. The Shinnecock Inlet provides access to the Atlantic Ocean. The area surrounding the commercial fishing docks is considered to be "Shinnecock." The separate villages of the area consolidated under the name of Hampton Bays in 1922, in order to take advantage of the increasing tourism to the region (http://www.hamptonbaysonline.com/external/historical_history.cfm#intro). Hampton Bays is significantly dependent on its commercial fishing fleet. According to 1990 census data, 3.63% of the residents of Hampton Bays, and 5.59% of the residents in Shinnecock were employed in agriculture, forestry, and fisheries, relatively high percentages for the urban-industrial northeast/Mid-Atlantic region. The area is also dependent on seasonal tourism as evidenced by 2000 U.S. Census data (Table NY). In 2000, 29.06% of the housing units in Hampton Bays were vacant, and of these 84.28% were used for seasonal, recreational, or occasional use.

Fishing Infrastructure

The offshore commercial fishing fleet is concentrated on the bay side of an isolated barrier island, to the west of Shinnecock Inlet. According to a fisheries management official, Shinnecock Inlet has a tendency to silt over, which can completely curtail ocean fishing. The official said that when the inlet silts over now, Shinnecock/Hampton Bays plummets in importance as far as landings go, whereas it usually vies with Montauk as the most important port on Long Island. The Shinnecock informant said that the last time the inlet closed up the federal government dredged the inlet very quickly. Pressure from the commercial fishing industry expedited the process (McCay and Cieri 2000).

The commercial docks are located on an isolated stretch of road, far removed from residential neighborhoods and beachfront rental property. They are bounded on the east and west by county parklands. The nearest building is a public beach access facility located a few hundred yards to the west of the dock area.

There are one municipal dock, two privately owned facilities for packing catch that have limited docking space, and a fishing cooperative that operates as a packing facility and a dock. According to data gathered in 1999 by key informants, there are 24 slips at the Municipal Dock but only 18 are being used by vessels, the other 6 being in a state of disrepair. The fishermen lease their slips from the town. The dock was created as the result of lobbying by one of the fishermen about 12 years ago and was financed by federal, state and local money. Since that time, the town and the county have been fighting over who owns it and should administer it (McCay and Cieri 2000). The manager of one of the commercial packing facilities indicated that dock space is severely limited. He and other fishermen have made numerous attempts to convince the county of the need for expanding the municipal dock but have not been successful.

Next to the municipal dock is a fish packing facility that also has four slips for commercial boats. The business sells ice and fuel to fishermen. According to one informant, eleven boats pack with this company. Next to this business is a fishing cooperative that packs out between 13 and 15 boats. The coop buys fuel, ice and other supplies in bulk, which is necessary in order to keep members' costs down. Most of the fish that's brought into the coop is sold to Fulton Fish Market, though some of it goes to local buyers. The business on the other side of the coop packs commercial landings and also provides slips for recreational/pleasure boats. The owner of this operation also runs a restaurant on the premises. There is a large fillet operation with a retail market in Shinnecock/Hampton Bays. Shinnecock/Hampton Bays has also been a surf clamming port but demand for clams from New York State waters has been low (McCay and Cieri 2000). Many of the marine supplies for the commercial fleet come from a well-known business in nearby Riverhead, Long Island, which services other ports in the eastern end of Long Island as well.

Fishing Overview

Codes for both Shinnecock (or Shinnecock Hills) and Hampton Bays are used in the NMFS weigh-out data. These are combined in this analysis because both refer to the same fishing port.

Shinnecock/Hampton Bays is primarily a dragger fishing port. Otter trawl landings accounted for 84% of the poundage and 74% of the value in 1998. Silver hake (whiting) and *Loligo* squid made up over 70% of these landings. Loligo accounted for 23% of the landings by weight and 27% by value in 1998. Butterfish, Atlantic mackerel, and Illex squid were much less important. Draggers landed 66 other species, reflecting the diversity of the region’s fisheries. Gillnets were second in importance, accounting for 12% of the value of landings in 1998. They too had diverse landings, totaling 39 species, led by bluefish, monkfish, and skates. Bottom longlines were used for tilefish and pelagic longlines for swordfish and tunas. There is also a diverse assemblage of inshore techniques, including haul seines, pound-nets, pots (for crab, fish, eel, conch, and both inshore and offshore lobster), fyke-nets, and the shellfish techniques of shovels, rakes, and "by hand" (McCay and Cieri 2000).

Squid, Atlantic Mackerel, and Butterfish

Loligo and butterfish are important to the trawler fishing fleet that operates out of Shinnecock/Hampton Bays. There were approximately 30 draggers working out of Shinnecock/Hampton Bays in 1999: 10 in the 45' to 60' range; 16 in the 60' to 65' range; 4 boats between 80' and 90'; and, 4 boats over 90' in length (McCay and Cieri 2000). In 2000, 64 boats (many from other ports) landed *Loligo*, which was 66% of all the boats that landed catch in Shinnecock/Hampton Bays in that year. Forty-nine boats, or 50.5% of all boats that packed in Shinnecock/Hampton Bays, landed butterfish in 2000. Mackerel, though less important in overall value, was landed by 35 boats, or 36% of the boats that landed catch in Shinnecock/Hampton Bays in 2000. *Illex* is infrequently landed at this port due to the highly perishable nature of *Illex* and the need to transport it in boats set up for RSW (refrigerated sea water). The commercial draggers that land *Loligo* and butterfish at the three packing facilities engage in a mixed-trawl fishery. Like the draggers in Montauk, the fishermen target a diversity of species depending on the boat size, season, and regulations. A number of the draggers that land here also engage in the groundfish fishery during the summer months.

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

Fishing Community/Relations

Inshore fishing has a long history in Shinnecock/Hampton Bays. Offshore commercial fishing started late relative to other places on Long Island due to the time needed to stabilize the Shinnecock Inlet in the 1950s (McCay and Cieri 2000). Most of the boat owners/operators and crew members live in Shinnecock/Hampton Bays. According to one informant, there are a number of fishing families that have historical roots in the area. This is primarily the case for baymen, but a number of offshore draggers also have roots in the area and strong family ties to the industry. However, like Montauk, a number of fishermen are first generation who came to the area from towns further west on Long Island. Many of the dockworkers in the area are immigrants from Central and South America.

Overall, the relationship between the fishermen and the municipality has been positive. According to one informant, the town has been supportive of the local fishing industry. However, fishermen have lobbied unsuccessfully for an expanded municipal dock and the area remains difficult if not impossible to develop for the commercial industry. Commercial fishermen in the area have also organized efforts designed to convince the federal government to assist in dredging the Shinnecock Inlet (McCay and Cieri 2000).

Greenport, NY

Greenport is the largest fishing port on the North Fork of Long Island. The village was a prominent whaling port in the early to mid 1800s and later became an important port for menhaden or "bunker" fishing and processing between the mid 1800s and the mid 1900s. Oystering was also an important industry up until the mid 1900s. At one point there were 14 oyster processing companies in the port (http://www.greenport.cc/ourhist.htm). Today, commercial fishing is still important in Greenport, but the economy has increasingly become geared to the tourist trade. A sign that greets visitors who come across the North Ferry from Shelter Island welcomes people to Greenport: "Shopping Hub of the North Fork." Despite the growing tourist trade, the town has demonstrated a commitment to maintaining Greenport's "working waterfront."

Fishing Infrastructure

The number of commercial fishing boats in Greenport has declined over the past several decades. In 1999, one informant estimated that there were 5 large offshore vessels, one medium-sized dragger, two small 40' draggers, 3 trap vessels (with pound nets), approximately 4 lobstermen, 4 or 5 people who do conch potting, 4 or 5 gill netters and 25 or so baymen (McCay and Cieri 2000). Two large scallop boats owned by a company in Cape May, NJ use Greenport's docks for repairs, but they land their catch in New Bedford and New Jersey.

The municipal Railroad Dock, located next to the North Ferry on Peconic Bay, is the primary commercial dock used by the large boats. The village leases the space from the train company and charges fees for tying up at the dock and for the use of water and electricity. The village has also provided a municipal dock for baymen located in Stirling Harbor. There is one packing facility located in Stirling Harbor that usually packs 2-3 small draggers and a number of small handline, trap, and gillnet boats. They also pack an occasional longliner. This facility also runs a retail fish market. The business sells some of the product landed at the fish market, while the rest is typically sent to Fulton Fish Market on consignment. They provide their own ice and cartons and pay for the shipping. A whiting exporter recently moved out of the area and relocated in Massachusetts. Greenport used to have another packing and processing facility, but this went out of business some 15 years ago. Greenport is also home to a shipyard and a welding company that gets business from commercial boats that come from other areas. The one marine supply shop in Greenport no longer operates as a supply shop. The owners now use the business for commercial rental space and as a freezer facility for the storage of bait for area lobstermen.

Fishing Overview

Otter trawling accounted for 95.6% of the total poundage and 92.5% of the total value landed in Greenport and nearby Mattituck in 1998. Species harvested were led by silver hake (46.1% of total value) and *Loligo* (27.2% of total value), but also included butterfish, summer and winter flounder, scup, striped bass, monkfish, and other species. Pound-net fishing, haul-seining, gill-netting, handlining, pelagic longlining, lobster and conch pot fishing, and raking for clams and dredging for bay scallops also accounted for landings in 1998. (McCay and Cieri 2000).

Squid, Atlantic Mackerel, and Butterfish

Loligo and butterfish are important to the draggers that operate out of Greenport. In 2000, 11 boats landed *Loligo*, which was 61% of all the boats that landed in Greenport that year. *Loligo* accounted for 16.1 % of the total value of catch landed in Greenport in 2000. Eleven boats, again, landed butterfish in 2000. Butterfish accounted for 11.8 % of the total value of landings in Greenport in 2000. Very small quantities of mackerel and *Illex* were landed in Greenport. The smaller draggers of Greenport engage in a mixed trawl fishery, targeting a diversity of species, depending on seasons and regulations. In addition to dragging, the fishermen of Greenport engage in a diversity of additional fishing activities such as clamming, pound-netting, trapping, and gillnetting. The diversity of activities has allowed the fishermen to adapt to the changing natural and regulatory environments. One fisherman from Greenport explained that he used to do more squid fishing, but that the recent Scup GRAs made it difficult to make squid fishing profitable. He stayed with groundfishing all last winter, landing his catch away from Greenport, in places like New Bedford. The recent groundfish ruling, which is going to reduce his operations by 40%, will drive him to do more squid fishing than he has done recently. According to this informant, the other draggers who pack out of Greenport already rely heavily on *Loligo*. Regulations and state-by-state quotas are a concern to local fishermen because reduced limits have forced them to fish in different waters and pack their catch in different ports (McCay and Cieri 2000). One fisherman noted that area closures, if they occur, will be "another nail in the coffin" of the industry.

Fishing Community/Relations

The Village of Greenport is said to be "fisherman friendly," and is generally more supportive of the fishing industry than other communities according to informants. Greenport projects an image of being a seaport community through its tourism literature and waterfront revitalization efforts. The village features a maritime museum and also hosts a maritime festival. One example of the village's commitment to commercial fishing involves a local fish processing plant. Condominium residents located near the plant complained about noise and smells associated with the plant's operation. The village board upheld the plant's right to operate as it saw fit because it had been there for 100 years while the condominiums had just been built. The board said that while the plant must comply with health regulations, it could operate in the middle of the night if it had to in order to ship fish. The board had previously changed zoning so that no new condominiums could be built in the commercial waterfront district. A second development already existed and was allowed to stay (McCay and Cieri 2000). Greenport's waterfront revitalization program, which is the first in the state, includes a clause protecting the commercial docks. The "Waterfront Commercial" zoning areas allow most uses related to commercial fishing, often to the exclusion of other uses (McCay and Cieri 2000).

Despite the village's commitment to the fishing industry, one informant pointed to the reduced number of boats and the loss of fishing infrastructure as signs of the decline of Greenport's fishing industry. According to one fisherman, the reason for the decline is associated with the over regulation of fish stocks, restrictive quotas, and New York State's apparent lack of commitment to commercial fishermen.

Freeport, NY

Commercial fishing activity in Freeport, Nassau County, is concentrated in two areas - along a revitalized waterfront area known as "Nautical Mile," and in Point Lookout, a small beach town on the south side of Jones Inlet, across from Freeport. Freeport began promoting itself as the “Boating and Fishing Capital of the East” in the 1940s (http: www.lihistory.com/spectown/hist001k.htm). Commercial fishing has been declining in the area over the last several decades as tourism has expanded. According to one fisherman, "Nautical Mile" was once the homeport of 15 draggers. There are only four draggers that operate from small docks in this vicinity now, as well as a small number of lobster, clamming, and potting boats. A strip of restaurants, marinas, fish markets and small businesses that rely on tourism now dominates the waterfront. The canal that provides access to the bay is packed tightly with party boats, charter boats, gambling boats, and numerous pleasure craft. Unlike port towns located further east on Long Island, Freeport is much less reliant on seasonal tourism. In 2000, only 2.28% of the housing units were vacant, and of these only 14.6% were used for seasonal, recreational, or occasional use (Table NY).

Fishing Infrastructure

The following profile on Point Lookout comes from data gathered in 1999 (McCay and Cieri 2000). The main commercial fishing business in Point Lookout is family-run and consists of a wholesale fish market, retail fish market, clam bar and restaurant. The restaurant was started in part because a developer was going to build residential units right out to the waterfront on the land next to the business' dock. Not long ago there was a boatyard across the street where there are now only parking lots and private homes. The business has freezer space for 15-20,000 lb. of product. According to one informant who was interviewed in 1999, the business runs two of its own boats while other owner/ operators sell exclusively to it. Each boat has four crewmembers and multi-species permits. The business also buys from five local gillnetters. The business has a network of over 100 local restaurants that it wholesales to; the rest of its wholesale product goes to Fulton's Fish Market. Between the four phases of the business they employ 30-35 people at any one time, 10 of those on the fish dock. All the dock's crew and employees live within a couple of miles of the dock. According to one informant at the business, there used to be fourteen trawlers tied up in Pt. Lookout and that the operation used to do a lot of out-of-state business. Now all their sales are local. However, another observer reports that out-of-state boats still land there. In addition to this operation, there is a surf clam processing plant on the same road that has been in the seafood business since the beginning of this century. It primarily handles surf clams caught in New York state waters as well as other shellfish. Several surf clam boats also work out of Freeport (McCay and Cieri 2000).

In the town of Freeport, three fish docks are located along the waterfront of the "Nautical Mile" on Woodcleft Road. One of the docks also runs a seafood restaurant and retail market. One dragger ties up and unpacks here. A separate commercial docking and packing facility is associated with another fish market. There are 2 draggers and a number of lobster boats that dock and pack with this operation. The commercial infrastructure is literally surrounded by pleasure boats, party and charter boats, gambling boats and a host of tourist related businesses.

Fishing Overview

According to NMFS weigh-out data (which do not include all landings by port, including surfclams, which are important to Freeport), Freeport and neighboring Point Lookout (included in the Freeport port code) are almost entirely dependent on otter trawl landings. In 1998, otter trawling accounted for over 89% of the poundage, and 87% of the value. The primary species landed included *Loligo* (39.3% of total value) and silver hake (16.2% of total value), with smaller amounts of scup, weakfish, bluefish, butterfish, summer flounder, other flounders, and Atlantic mackerel. Gillnet, small handline, pot, pound-net and bay shellfisheries were also associated with these ports in the weigh-out data. These data are misleading in that surfclams were not reported by port in 1998.

Squid, Atlantic Mackerel, and Butterfish

Loligo is important to the draggers that operate out of Freeport, as is butterfish to a smaller degree. In 2000, 18 of the 43 boats that landed catch in Freeport landed *Loligo*. *Loligo* accounted for 45.5 % of the total value of landings in Freeport in 2000. Twelve boats, or 27.9% of all boats that packed in Freeport, landed butterfish in 2000. Butterfish accounted for 2.8% of the total value of landings in 2000. Very small quantities of mackerel were landed in Freeport.

The smaller draggers of Freeport engage in a mixed trawl fishery, targeting a diversity of species, depending on seasons and regulations. They are day boats for the most part, leaving in the early morning and returning by day's end. One fisherman who owns a 60' dragger said that he fishes for *Loligo* full-time from mid-May into August. He explained that regulations, including highly restrictive trip limits, prevent him from fishing for fluke when he is most capable of catching them. *Loligo* fishing has become a necessity. From January 1 to May 1 they can catch a limit of 500 lbs of fluke, but this is when the fish are offshore. The limit gets cut down precisely when the fish come inshore which prevents him from profiting because he has a smaller, inshore boat. This forces him to concentrate on *Loligo*.

Fishing Community/Relations

According to interviews conducted in 1999 the relationship between fishermen and the local community are strained (McCay and Cieri 2000). One informant explained that the town of Freeport was opposed to the idea of having a cooperative commercial fishing dock despite lobbying efforts on the part of local fishermen. He thinks they are developing the area for tourists and pleasure boaters, squeezing the commercial fishermen off the docks. According to him, the town views the fishing operations as an eyesore and an impediment to the development and revitalization of the waterfront. He thinks that the commercial fishermen are being pushed out. In June of 1999, major upgrades were being made to the road that ran directly in front of the commercial operations. According to the informant, the new sidewalk took away their parking. The relationship between the fishing industry and the town of Point Lookout is reportedly much less problematic. According to one informant, relationships with the community have been good and there has been no pressure to force them off the docks to this point. He added that he "pounds the people with pro-commercial fishing propaganda" (McCay and Cieri 2000).

Brooklyn, NY

Commercial fish landings in New York City's boroughs have declined markedly over the years. Landings for Brooklyn amounted to less than 30,000 pounds in 1998, mainly from otter-trawling and sink gillnets. The principal species, out of 17 landed, were butterfish, bluefish, weakfish, and *Loligo* squid. Sport fishing at Sheepshead Bay and other sites has become more important than commercial fishing in recent years. Table (NY) presents 1990 and 2000 census data for Brooklyn.

Loligo accounted for 28.5% of the total value of landings in Brooklyn in 2000. Fifty percent of the boats that landed catch in Brooklyn landed *Loligo*. There is a major *Loligo* processing plant in Brooklyn. This facility employs 50 full-time employees, including 40 processing personnel, and 10 secretarial and managing personnel. The number of processing personnel increases by 15 to 20 workers in the winter when more *Loligo* is being caught. Fifty percent of the company's processing personnel are Hispanic and 20% are female. For the most part, the employees are long standing Brooklyn residents who grew up in the area. According to one of the operation's managers, it is difficult to find employees, but they have a stable workforce with very little turnover. Nearly 100% of the business is based on the processing of *Loligo*. The *Loligo* is trucked in fresh from Cape May, Montauk, and Shinnecock. It is cleaned and packaged into 2.5-pound boxes that are made ready for sale. The product is shipped all over the U.S. but Long Island is the biggest market. The company buys *Loligo* from 10 to 15 boats on a consistent basis. He has been buying from the same boats for 10-12 years and although there has been some flux, the same boats have been fishing for squid through the years. According to the informant, the business is extremely important to the local Brooklyn area. The company makes a point of dealing with local businesses for supplies, trucking, and storage.

<u>New Jersey's Fishing Ports and Communities</u>

New Jersey is the most densely populated and one of the most industrialized and urbanized states in the nation. Although small in area, it also has a long coastline, about 100 miles, as well as two major tidal rivers, the Hudson and Delaware, and numerous estuaries inside its barrier islands and embayments. Much like New York, Connecticut, Rhode Island, and Massachusetts, its fisheries are found in both urban and rural settings and are often embedded in communities with very different orientations, whether industrial or tourist.

The major ports in New Jersey for the Squid, Atlantic Mackerel, and butterfish fisheries are Elizabeth, Point Pleasant, and Cape May (Table 1). Cape May ranked 3rd overall for fisheries value and 3rd for SMB in the northeast in 2000. It ranked 7th for dependence on these species. Point Pleasant ranked 4th in 2000 in terms of fisheries value; it ranked 8th for the value of SMB, and 11th in dependence on SMB fisheries that year. Elizabeth is an old industrial port city; its commercial fishing activities area very small, the catches going to a processing plant in the city of Newark, NJ. However, the value of Elizabeth s SMB fisheries ranks 12th, and it holds the top spot in the northeast for dependence on these fisheries (Table 1). The port of Belford also has significant landings of these species, and the recreational fisheries of Atlantic Highlands, Brielle, Cape May, and other ports are at times significantly involved in the Atlantic mackerel fisheries, but these are not discussed below (see McCay and Cieri 2000 for more information).

Union and Essex Counties, NJ

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

Union County, the site of the port of Elizabeth, is small in area, densely populated, highly urbanized and bounded on the east by the Newark Bay and Arthur Kill. Essex County is just to its north, dominated by the large city of Newark, the container port of Newark Bay, and Newark International Airport. Both are urban areas with high proportions of minority populations and large pockets of unemployment and poverty (Table NJ-1). In 2000 over 35% identified themselves as other than “white” in Union County, and over 63% in Essex County. Fisheries are extremely minor in terms of employment: in 1990 0.2% were in the occupational category of agriculture, fisheries, and forestry. However, unemployment is very high, especially in Newark, making the provision of any jobs there very important.

Elizabeth, NJ

The city of Elizabeth is located along New Jersey's northern waterfront, on Arthur Kill between New Jersey and Staten Island, New York. Elizabeth is one of New Jersey s oldest cities. It has gone through a long period of urban decline, recently checked by the creation of regional shopping centers on its periphery. In 2000 the population was 120,568, a 9.6% increase since 1990. In 2000 fifty percent of the population were Hispanic, 20% black (Table NJ-1). Twenty-five percent of the houses were vacant, and 19% of the family households were headed by females. The people of Elizabeth match the county's percentages for high school graduates. However, the percentage of people with bachelor's degrees, 7.5%, is less than the county level.

Newark, NJ

The city of Newark had a population of 273, 546 in 2000, a slight decline from 1990 (Table NJ-1). The white population was only 26.5% of the total. Fifty-five percent identified wholly or in part as black or African-American, and over 29% indicated Hispanic or Latino. The median age was 30.8, and 29% of the households were female-headed. In 1997 26% were living in poverty (compared with 16% in Elizabeth and 9.3% for the state as a whole).

Fishing Infrastructure

Although the fishery of Elizabeth is very small relative to that of other ports, it is particularly dependent on Loligo and Illex squid. *Loligo* accounted for 70% and *Illex* 21% of the value of total landings in Elizabeth in 2000. The squid and fishes offloaded in Elizabeth are processed at a plant in the city of Newark, NJ.
The owner of the Newark plant and one vessel that offloads in Elizabeth indicated that about 98% of his company's business comes from squid, primarily *Loligo*. He was the first one to start processing Loligo squid in this region, in 1977. In addition to the catch of his own vessel, he buys squid from 12 to15 docks in Rhode Island, Long Island, New Jersey and Virginia. The plant employs 8 skilled, 7 semi-skilled, and 105 unskilled workers who clean and pack mostly squid. The semi-skilled team captains and the unskilled line workers are almost entirely women, foreign-born, and speakers of Spanish or Portuguese, who are paid on a wage basis.

Ocean County, NJ

Ocean County is a long, large county the coast of which is dominated by seasonal tourism and commuter and retirement housing, shopping, and services. The commercial and recreational fisheries of Ocean County have very long histories of being ensconced in complex communities. A century ago, the barrier beach communities of Ocean and neighboring Monmouth County were referred to as the Riviera of the Atlantic because of the early development of elegant hotels and homes along the beaches, which the fishing communities supplied. Today Ocean County is more often called The St. Petersburg of the Northeast (Sokolic, 2001), referring to the fact that it has the largest retirement communities in the State. Several important fishing centers are found in Ocean County, particularly Point Pleasant, at the Monmouth County boundary, Barnegat Light, on one of the long barrier islands, and small bayman places such as Forked River and Cedar Creek. Sport fishing is done from every coastal community, especially those surrounding Barnegat Bay and Toms River. Major charter and party boat fleets are concentrated in Point Pleasant and Barnegat Light, where there is ready access to deep-draft inlets to the sea.

The total population in Ocean County was 510,916 in 2000 (Table NJ-2). This was an 8.6 percent increase from 1990. Ocean County has grown rapidly from coastal tourism, retirement community development, and general suburban expansion within the NY-NJ Metropolitan Area. In 1990, only 20.4% of the population was rural, and less than 1% lived on a farm. The population is ethnically diverse: In 2000, the white population was only 65.9% of the total. Twenty two percent were 65 years of age or older, and the median age was 41 years, making it second in New Jersey only to Cape May County, where the median age was 42.3 years.

In 1999, Ocean County had a per capita personal income of $27,694. Based on a 1997 model based estimate, 7.8% of the population was classified as living in poverty, compared with 9.3% for the State as a whole. In 2000, 3.9% of the population was unemployed. In 1990, of the employed persons 16 years of age and older, 1.5% were in the agriculture, forestry, and fishery industries sector.

Point Pleasant, NJ

Point Pleasant comprises the municipality of Point Pleasant Beach and Point Pleasant borough, located at the mouth of the Manasquan Inlet, where Ocean County borders on Monmouth County. The town's economy is geared toward the summer tourist and recreational business, as shown by the fact that according to the 2000 census, 26.6% of the vacant housing units in Point Pleasant Beach were used for seasonal, recreational, or occasional use (the figure for Point Pleasant borough, the more residential part of the town, was 6.4%).

The fisheries are concentrated in an area known as Channel Drive in Point Pleasant Beach, a sandy strip on which are found restaurants, a fisherman's supply store, small marinas, charter and party boat docks, and two large commercial fishing docks as well as several smaller ones. Although tourism is the major business, the town recognizes and builds on its commercial and recreational fisheries. For example, the web-site www.pointpleasant.com features a photograph of a memorial to fishermen who lost their lives at sea, as well as advertisements for local party boats.

According to the 2000 Census for Point Pleasant Beach, the population was 5,314, a small (3.95%) increase from 1990 (Table NJ-2). Point Pleasant borough was much larger in 2000 with 19,306 persons, a 6.21% increase from 1990. There are very few minority residents. In 2000, 95.9% and 97.8% of the population in Point Pleasant Beach and Point Pleasant borough were white, respectively. Mirroring the county as a whole, the median ages are high: 39.4 years for the borough, and 42.6 years for the beach.

Per capita incomes for 1999 were considerably lower in Point Pleasant than in the county as a whole (about $28,000 for the county, $19,000 for the borough and $16,500 for the beach) (Table NJ-2). In 1990, 1.45% and 3.0% of the persons 16 years of age or older were in the agriculture, forestry, and fisheries industries sector in Point Pleasant Borough and Point Pleasant Beach, respectively, an indicator of the importance of fishing. However, interviews conducted in 2002 indicate that most of the fishermen do not live in Point Pleasant Beach or Point Pleasant Borough but rather are spread among many other towns of coastal New Jersey.

Fisheries Infrastructure

Point Pleasant is primarily an ocean fishing port, with a long history involving ocean pound-nets and otter trawl and gillnet fisheries, as well as sportfishing, focusing on the nearshore wrecks and the offshore canyons of the New York Bight. In terms of landings, the commercial fisheries of Point Pleasant rank third in New Jersey to those of the Cape May-Wildwood area and Atlantic City.

Like so many ports of the Mid-Atlantic region, the port of Point Pleasant Beach 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, in Monmouth County. This is a highly developed coastal region. Currently, there is a wholesale finfish packing dock and seafood retail store at Point Pleasant run by a fishermen's cooperative. Another dock is primarily used for offloading surfclams and ocean quahogs although finfish may be handled there as well. A dock once used for pelagic tunas and swordfish is now being used by a lobster boat.

As elsewhere in the Mid-Atlantic, the fisheries of Point Pleasant Beach are very diverse. 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. However, sea scallop dredging has been very important, as are surfclamming/ocean quahogging and offshore lobstering. According to the 1998 landings (McCay and Cieri, 2000), the most valuable species 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 , followed by *Loligo* squid, a major focus of the local dragger fishery in the last decade. Also important were 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 port from the 1970s through the 1980s but its availability and abundance have since declined. In terms of pounds landed, menhaden (purse-seined) and surfclams 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. The total landings value for 1998 was over 16 million dollars, indicating the high value of the fisheries to the local economy and community.

Two of the fishing properties in Point Pleasant are owned by a Cape May seafood business. Each of these docks had been used for finfish until about 10 years ago. They are now used for offloading and trucking surfclams and ocean quahogs. From 6 to 10 boats, most homeported in Atlantic City or Cape May, land clams and quahogs here. There are 15 crew at the docks and up to about 50 on the boats, many of whom commute from South Jersey or even other states to the south. In 2000 a small hand-shucking plant for surfclams began business and continues in 2002 at a site that had been a surfclam processing facility in the 1960s and early 1970s.

A fishermen's dock and marketing cooperative owns two other waterfront 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 market with a small restaurant (which serves both local fishermen and tourists alike). The cooperative mostly depends on its sixteen or so members, who have switched from older, wooden-hulled vessels to larger steel-hulled boats. They are outfitted 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 crewmembers are not often related to the captain or owner. Members of the cooperative are typically first-, second-, or third-generation immigrants from Northern and Mediterranean Europe and other places. A few women have crewed on these boats. The boats are all owner-operated. They tend to fish in areas of Hudson Canyon and "the Mudhole," an area between the Hudson Canyon and the mouth of the Hudson River.

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 by the latter 1990s accounted for over 50% of the landed value of Point Pleasant trawlers. At first *Loligo* was a by-catch while silver hake fishing in the Gully. Then it was targeted by most 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 processors in Cape May, Newark, and elsewhere in the region. 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.

Declining catches and restricted fisheries, especially the scup GRAs [gear restricted areas] during the winter along the continental shelf, have hurt this fishing community severely. It is estimated that the GRAs have reduced the landings by 30 to 35% for the local cooperative (mostly for *Loligo* squid). Some boats have left the fishery or are for sale. Existing operations have difficulty investing in major improvements, either to the waterfront properties or to the vessels. However, even in the face of these difficulties, members of the cooperative banded together in order to raise enough money to make the required dock repairs, approximately one million dollars. It is this investment that the fishermen feel is necessary in order to compete and have an appropriate facility. Their fear is that with increased restrictions on what, where and when they can fish their profit margin will be so small that it will be impossible to meet the financial obligations.

Point Pleasant Beach also has a sizeable charter/party boat fleet which, like the neighboring one of Brielle, is well known for diverse fishing opportunities, including overnight and two-day offshore canyon trips and nearshore, bottom-fishing and wreck fishing. The Channel Drive area also hosts a recreational marina, a fisherman's supply company, and popular seafood restaurants. Nearby is a popular amusement park and beach and a U.S. Coast Guard station.

Squid, Atlantic Mackerel, Butterfish Fishery

In Point Pleasant, *Loligo* squid are more important than *Illex*, butterfish, or Atlantic mackerel. All but one of the members of the cooperative fish for *Loligo* during the winter months. According to the manager, *Loligo* squid makes up about 25% of the annual catch (value) for the draggers. However, while out targeting squid it is common to find large schools of butterfish and occasional Atlantic mackerel, especially in the areas around the head of the Hudson Canyon and the Hudson Canyon itself.

Point Pleasant's fisheries have declined. In 2001, 81 boats landed in Point Pleasant, down from 123 in 2000 and 142 in 1997, and the total value of fish landed declined by 63% from 2000. In 2001, *Loligo* represented only 3.4% of the total value landed in Point Pleasant (which was dominated by surfclam and ocean quahog landings). In contrast, Loligo landings represented 9% of the total value of landings in 1994. In 2000 and 2001, Illex, butterfish, and mackerel contributed very little to the total value in Point Pleasant, even though they are recognized as important, especially to the recreational fisheries.

SMB and the Recreational Fisheries

Recreational fishermen use Atlantic mackerel in three ways: food, fun, and bait. As a food first generation Italians and other Mediterranean people enjoy it smoked, Asians eat it fresh (not smoked) and Polish people are said to can it. As a fun species, party boat captains report that it is a fun fish to catch because of the fight it puts up. As a bait, it is said to be a good all around bait, but especially good for sharks and marlin.

Atlantic mackerel is an important target for the party boat fishery in Point Pleasant (and elsewhere in the region). For many of the party boat fishermen and some of the charter boat fishermen Atlantic mackerel is a " fill in" or a "get you through" fish because it appears at times when other sport fish are usually not available.   Normally there are two discrete seasons, winter and spring, as Atlantic mackerel migrate up and down the coast, and these seasons tend to last from two to three weeks. The winter season is between late November and the beginning of January and the spring season is between mid-March and May. However, the winter and spring of 2002 saw Atlantic mackerel throughout the entire time period. Fishermen interviewed suggested that this was due to the warm air and sea temperatures. For some recreational fishermen, Atlantic mackerel makes up 12 to 15% of their annual trips, a significant contribution if not as important as bluefish, fluke or sea bass.

Recreational fishermen do not target squid, but there is little doubt about the importance of squid as bait, especially for the party boats going after fluke and sea bass. Most bait and tackle shops sell squid as a universal bait. Any reduction in the availability of squid for bait would diminish access to high quality bait for party, charter, and private boats, as well as shore and pier anglers.

Butterfish is not targeted by the recreational fishermen, but again there is little doubt to its importance in the recreational fishing industry as a high quality bait. It is considered to be such a good bait because once frozen and then used it holds its firmness and makes a good presentation in the water. Party boat captains say that butterfish is tremendously important for tuna fishing as well as bluefish. Considering the importance of both tuna and bluefish to the recreational fisheries of Point Pleasant and the larger region, a reduction in availability of butterfish would create a similar problem to that of squid. Charter and party boat captains are afraid that if they can no longer obtain such high quality bait, they will lose customers who otherwise are willing to pay large sums of money to run offshore to fish for tuna: why pay a large sum only to be "skunked" for want of high quality butterfish?

Fishing Community/Relations

The fishing community of Point Pleasant has received support of various kinds, including zoning for water-dependent uses which helps moderate the pace of gentrification of the waterfront. Although few fishermen live close to the docks, they use local supermarkets, convenience stores, and bars.

The fishing community of Point Pleasant was hard struck by the January 1999 tragedies in the surfclam and ocean quahog fishery. The Adriatic, the Beth Dee Bob, and the Ellie B, all working out of Point Pleasant, went down during storms that month, as well as another vessel, the Cape Fear, formerly based in New Jersey, up in Buzzards Bay, Massachusetts. Ten lives were lost. In the aftermath, members of the fishing community, led by the dock managers at the surfclam/ocean quahog dock, began the work of designing and funding a fishermen's memorial with support from the larger community. It was built by a local sculptor and set in a small park alongside the Manasquan inlet. The wall around it has the names of fishermen of this part of the coast who lost their lives at sea as well as the ship's bell of one of the vessels lost in January 1999. It is telling of the nature of Mid-Atlantic fisheries that both recreational and commercial fishermen are remembered on the memorial.

Cape May County, NJ

Cape May County, and the municipalities of Cape May and Lower Township, are major centers of the Squid, Atlantic Mackerel, and butterfish fisheries. Cape May County encompasses a large peninsula at the southern end of New Jersey, bounded by the Atlantic Ocean at one side and the Delaware Bay at the other. Its beaches have long been the focus of summer tourism, principally from the Philadelphia region, and in recent years the once rural county has also become the site of commuter and vacation home housing developments. However, both commercial and recreational fishing remain critical mainstays of the year-round economy of places like Cape May and Wildwood within the county.

In 2000 the population was 102,326, a 7.6% percent increase from 1990 (Table NJ-2). The minority population is very small, less than 8%. In 2000, the median age for Cape May County of 42.3 years was the oldest of any New Jersey county, bespeaking its increasing popularity as a retirement center. In 1999, Cape May County had a per capita income of $29,455. Based on a 1997 model based estimate, 11% of the population was classified as living in poverty.

Unemployment tends to be higher in Cape May County than in most other parts of the state. In 2000, 8.6% of the civilian labor force was unemployed. Of the individuals in the labor force in 1990, 7.5% of the civilian labor force was unemployed . In 2000, 2.1% of the population were in the agriculture, forestry, and fisheries industries sector, an indicator of the importance of fishing (but also farming) in this area.

Cape May and Lower Township, NJ

The area popularly thought of as Cape May, at the very tip of the peninsula, is a popular tourist destination, famous for its Victorian architecture and the high quality of its “bed-and-breakfast” inns and restaurants. It is treated in the census separately from the area where much of the fishing activity takes place, Lower Township, which is more diversified. However, both are part of the effective community of the fisheries. Cape May’s 2000 population was 4,034, actually a 14% decline from 1990, and that of Lower Township was 22,945, a 10% increase from 1990 (Table NJ-2). Both are predominantly “white” in race/ethnicity. The median age for Lower Township, of 42 years, is identical to that of the larger county, which is known to be a haven for retirees from the Pennsylvania/New Jersey region. Per capita incomes are lower and poverty levels higher in Lower Township than in Cape May (Table NJ-2). In 1990, 1.6% of the population of Cape May 16 years of age or older, and 3% of the equivalent population in Lower Township, was in the agriculture, forestry, and fisheries industries sector.

Fisheries Infrastructure

Commercial and recreational fishing docks are found in Cape May but the majority are clustered in Lower Township along Ocean Drive, a road that leaves the main highway and crosses the marshes toward Wildwood. Another major dock is found at Schellenger's Landing, just over a large bridge that connects the mainland with the center of Cape May and its beaches.

Cape May is one of the largest commercial ports on the Atlantic seaboard. When combined with neighboring Wildwood (the fishing port is often referred to as "Cape May/Wildwood"), its 1998 landings exceeded 93 million lbs., worth over $29 million. Finfishing, squid fishing, and scalloping have been very important. It is a highly diversified port (McCay and Cieri 2000).

In 1998 otter-trawl equipped draggers accounted for 69% of Cape May's landings and 70% of its value. As elsewhere in the Mid-Atlantic region, they are highly diversified, and some in Cape May are also used for scalloping. 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 (McCay and Cieri 2000). 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. Scup is another dragger-caught species of historic importance in Cape May. 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 (McCay and Cierri 2000).

A city planner interviewed in 1999 estimated that 500 people work in the fishing, processing, fresh fish market and restaurant enterprises of Lower Township and Cape May (McCay and Cieri 2000). However, “gentrification” has taken hold in Cape May as in many other coastal communities of the northeast and the mid-Atlantic. Despite being the most important commercial fishing port in New Jersey, commercial fishing businesses and uses of the waterfront are considered by planners and business people as lower priority than recreational and resort-oriented uses. Private recreational boating and fishing marinas are said to be a powerful political force in the township. Cape May has a substantial recreational fishery, both for-hire and private boat. Whale watching and dinner cruises have emerged as a profitable alternative or adjunct to recreational fishing charters (McCay et al 2002).

Schellenger s Landing is the most visible center of fishing in the Cape May area. Although most obviously a large restaurant and fish market, it is zoned “marine general business” with allowance for expansion of the marine industrial character. There is also a marine railway nearby. Other marine-related businesses in and around the landing include two recreational marinas, two marine suppliers, two bait and tackle shops, a whale research center, and a "marlin and tuna club." Also there are a pizza shop, a motel, a bar, a wildlife art gallery, an antique store, two restaurants, and a gasoline station. Some cater to people in the fishing industry and some do not. Further expansion of the fishing industry, commercial or recreational, is limited by the high cost of land near the waterfront (McCay et al 2002).

Lower Township has three "marine development" zones located along Ocean Drive, towards Wildwood, at Two Mile Landing and at Shaw Island and Cresse Island adjacent to Wildwood Crest. Recreational boats currently use these areas. Across from Shaw Island is a new development, where 325 new slips are being built. A complex on a saltwater creek includes a marina, bait and tackle, marine supply, and charter boats. The marina itself is small, about 28 slips. Access to this particular area is now difficult for large vessels because of silting due to a canal built between Cape May and the mainland (McCay et al 2002).

Ocean Drive is the location of several important commercial fishing businesses. One commercial fishing business in the Ocean Drive area owns a surf clam/ocean quahog vessel (currently at Point Pleasant) as well as a freezer trawler and seven “wet” boats and 2 refrigerated seawater (RSW) vessels. According to its owner, at this facility there are 15 shore employees, approximately 20 seasonal packers, and about 45 crew on the boats.(McCay et al 2002).

There are two other large commercial fishery companies on Ocean Drive, both of which are largely involved with finfish. One has a long history as a processor, wholesaler, and exporter. In 1999 14 vessels landed their catch here full-time, including a couple of freezer trawlers. Crew sizes are 3-5 men, and 8-9 for the freezer trawlers. There were 75 to 80 shoreside employees. In 1999 about 40% were Hispanic, 40% white, and 20% African-American, Asian, and other. They lived in the Cape May and Cumberland County region; many of the Hispanics came from the agricultural town of Bridgeton (McCay and Cieri 2000). The second large firm has a retail store as well as packinghouse and processing facility. There were 15 boats in 1999. About 20 people worked on the dock and in the retail store, and in 1999 at the time of a visit to the facility, about 35-40 people were processing squid. Five or so were Black-Americans. The rest were identified as Vietnamese, who came daily to work from Philadelphia through a labor contractor. Since then this firm has filed for Chapter 11 bankruptcy (McCay et al 2002).

Squid, Atlantic Mackerel, and Butterfish

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

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

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

Fishing Community/Relations

Although Cape May portrays itself as a Victorian seaside resort with "gingerbread" homes and inns, it also includes emblems of the fisheries. A pamphlet "This Week in Cape May" lists a 45-minute Fisherman's Wharf Tour that is scheduled to occur four times in May and June at the above-mentioned dock and fish packing plant. The tours are sponsored by the Mid-Atlantic Center for the Arts. There is a bronze plaque for fishermen lost at sea in a central pedestrian mall. A fisherman's memorial at the end of Missouri Avene portrays a woman and a child looking out to sea. A fishermen's wives organization, now defunct, played a major role in creating this memorial. The inscription says,

Dedicated to the fishermen lost at sea - 1988
He hushed the storm to a gentle breeze,
And the billows of the sea were stilled .

Many of the captains of fishing vessels in Cape May indicated that they are from multigenerational fishing families. However, a few are first generation fishermen. Most of the captains as well as the crew live in Cape May County and many grew up in communities in or around Cape May.

A Seafood Festival in Cape May had been moribund for a while until it was taken over by the Chamber of Commerce in the mid-1990s. When asked whether the commercial fishers in the area had been involved in organizing or supporting the seafood festival, a representative of the Chamber of Commerce said that there is a "non-existent relationship between us and them. We tried, they tried, but it never worked out" (McCay and Cieri 2000).

One of the seafood companies has been very successful in marrying seaside tourism and the commercial fisheries (the Lobster Dock at Schellenger's Landing), but the other companies tend to keep their businesses separate from the larger community. As one of the managers said in an interview in the spring of 2002, "It's not like New England; people do not think of this as a fishing community even though fishing provides a lot of the jobs."

Hampton, Virginia

“Hampton Roads” is the fishing region at the mouth of the Chesapeake Bay which sees most of the EEZ fishing activity in Virginia. It is largely within the Metropolitan Statistical Area of Norfolk-Virginia Beach-Newport News. The "Hampton Roads" ports have close connections with Wanchese, North Carolina. They are within a major tourist region, anchored by Chincoteague, Williamsburg, and Virginia Beach. The military is also a large presence, as are numerous heavy and high tech industries. Chincoteague is also one of several ports where local seafood businesses depend on migratory fishing vessels from other regions, such as North Carolina or Massachusetts, for landings. The port of Hampton is the focus of this report; closely associated with Wanchese, in North Carolina, it has a recent history of significant engagement in the squid fisheries, including Illex, even though since 1998 these have been very minor due to shifts in the availability of the squid populations.

Hampton generally has a poor minority population, and fisheries are a very small part of the total employment mix (Table VA-NC). In 1990, less than 1% of the employed persons 16 years of age and older were in the agriculture, forestry, and fishery industries sector. The total population was 146,437 in 2000, a 9.5% increase from 1990. In 2000, the white population was 49.5% of the total, while Blacks and Hispanics made up much of the rest of the population. According to the 2000 census, the median age in Hampton is very young, 34 years. In 1999, Hampton had a per capita personal income of $22,250. Based on a 1997 model based estimate, 14.6% of the population were classified as living in poverty.

Hampton, like Newport News and nearby Seaford, is an important sea scalloping port. However, species diversity of the fisheries is extremely high. In 1998 there were 79 species landed, for all gear types, in Hampton and Seaford, combined (weighout data for these two ports were combined to preserve business confidentiality). 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 (McCay and Cieri 2000). The value of the landings in 1998 was approximately 13 million dollars, showing that despite little appearance of fisheries in census data, the fisheries are significant contributors to the local economy. The species of this FMP are particularly important to the otter trawl fleet of Hampton. In 1998 the otter trawl fleet of Hampton took Illex and Loligo squid, black sea bass; Atlantic mackerel; Atlantic croaker, and angler. Some draggers were also used for scallops, although most scallops were caught with dredges. A small amount of pelagic longlining was also done from Hampton, for sharks and tuna. Gill-netting, crab potting, and bay clamming were also important activities.

The fisheries have declined. In 1993 there were 192 boats landing one or more of the species of this FMP in Hampton, according to weighout data, but in 2001 only 43 boats landed there. The total value of all landings in Hampton in 2001 was about $8.8 million, down from $13 million in 1998. Both *Loligo* and *Illex* squid landings have declined to less than 1% of the total value of landings in Hampton. *Illex* have not been available to this fleet since the end of 1997, according to leading fishermen in the area. In 1997, mackerel landings accounted for 1.3% of the total value of landings in Hampton, but in 2001, mackerel and butterfish landings were negligible.

Dare County and Wanchese, North Carolina[1]

Squid, Atlantic mackerel, and butterfish are currently not very important to the fisheries of North Carolina, except as bait for other fisheries. In this report, Dare County and Wanchese are the foci. Wanchese-based fishermen often use Hampton, VA, and more northern ports.

[1]Commercial fisheries data are kept on a county basis rather than port basis by the North Carolina Division of Marine Fisheries, the source of the data used, and that many of the data are confidential, due to there being only one or two dealers involved.

Wanchese is the site of the primary landing facilities for the ocean-going trawlers of North Carolina. In the early 1990s 30 to 40 vessels offloaded at 6 fish houses in Wanchese (North Carolina Division of Marine Fisheries 1993: 4). Beaufort-Morehead City was the 2nd largest port, with 5-6 fish houses serving 10 to15 full-time trawlers. At that time there were 26 to 32 other otter-trawl draggers fishing out of both Oregon and Ocracoke Inlets and packing out of ports of Lowland, Vandemere, Bayboro, Englehard, Pamlico Beach and Oriental.

Dare County, NC

In 2000 the population of Dare County was 29,967, a 32% increase from its 1990 level. It is almost entirely rural. About 95% of the population was white, 2,7% were Black/African American, and 2.2% identified as Hispanic or Latino (Table VA-NC). The median age of the county's population was 40.4 years. In 2000, 74.5% of all housing units were owned and 52.4% were vacant. Of the vacant housing units, 50.1% were for seasonal, recreational or occasional use, reflecting the importance of tourism in the rapid development of North Carolina's Outer Banks.

In 1990, 5.35% of the civilian labor force were employed in agriculture, forestry, and fisheries, a very high percentage for the northeast and mid-Atlantic regions. There were 30 white male vessel captains or officers, as well as 391 male and 49 female fishers, living in Dare County, according to the Census Bureau. According to Diaby (1999: 35), the fishing incomes of Dare County in 1997 ($29,296) were considerably higher than all wages combined ($17,989), bespeaking the importance of fishing.

Profile of Dare County Fisheries

Dare County saw over 36.6 million pounds and 23.5 million dollars from fish and shellfish (and turtle) landings in 1998. 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 (McCay and Cieri 2000).

Since 1998, North Carolina s commercial and recreational fishermen have been affected by new fishery regulations (such as for dogfish and monkfish) as well as what is believed by fishermen to be a climatic shift causing a warming of the ocean and changing some of the migratory patterns of certain species. For example, while 1998 was a good year for squid landings, the three years after 1998 have been disappointing: the three years combined are not equal to 1998 (North Carolina Division of Marine Fisheries 2001).

Wanchese, NC

Wanchese is a small village on the Outer Banks that is heavily dependent on the fisheries. It is on the northern part of North Carolina's coast, not far from the Virginia border, and on the southern end of Roanoke Island, which is where English efforts to settle North America began–and failed. In 1990 the village, together with neighboring Nags Head and Roanoke Island, had only 1,374 residents, and in 2000 there were 1,527, an increase of 11% (Table VA-NC). The resident population is almost entirely "white," and the median age is 37.2, lower than that of the county as a whole. The per capita income in 1999 was very low, $10,830, and only 67% of those 25 years of age or older had completed high school. Tourism is much less important here than elsewhere on the Outer Banks: only 7% of the vacant housing units were used for seasonal, recreational, or occasional purposes.

In 1990, 20% of the community's workers were employed in "agriculture, forestry and fishing," the highest of all mid-Atlantic and northeast coastal communities. According to local residents interviewed in the spring of 2002, this level of dependency continues and may have increased. It is rooted in a history of commercial fishing that goes back to the 19th century (Wilson and McCay 1998). Today the village still revolves around fishing but has expanded to include processing plants and boat building (which began in 1992). Though traditionally a commercial fishing community, recent growth in tourism and recreational fishing has sparked competition between the new and the old for a restricted resource. However, residents interviewed in 2002 indicated that at least half, if not more, of the labor force of Wanchese and environs is engaged in fishing and boat building.

One of the major ethnic shifts, as reported by fishermen interviewed in 2002, is the increased numbers of Hispanic people working in the fish houses and plants, some of whom have reportedly settled in the Wanchese area. Hispanics have also come to Wanchese to work in the developing boat building industry, reportedly from the agricultural sector.

In 2001, a total of 116 boats landed in Wanchese. The number of boats landing in Wanchese increased dramatically from 1996-1997, from 45 to 95 boats. The number of boats landing in Wanchese continued to increase until 2000, to 119 boats. In 2001, the total value of all fisheries landed was over $8 million, and *Loligo*, *Illex*, butterfish, and Atlantic mackerel landings represented less than one percent of that value, altogether, in contrast with 1998 when *Illex* itself represented 1.2% of the total value.

Fishing Community/Relations

Fishing related associations include the Oregon Inlet Users Association and the North Carolina Fisheries Association. The former is involved with supporting the plans for jetties at Oregon Inlet; they are responsible for organizing both the Wanchese Seafood Festival and the Blessing of the Fleet. The latter is a trade organization of seafood dealers and commercial fishermen from the state; two members of the 18 member Board of Directors are from Wanchese.

APPENDIX 2
Glossary of Terms

A - See annual mortality.

ABC - See allowable biological catch.

AP - See advisory panel.

Absolute Abundance - The total number of a kind of fish in the population. This is rarely known, but usually estimated from relative abundance, although other methods may be used.

Abundance - See relative abundance and absolute abundance.

Advisory Panel (AP) - A group of people appointed by a fisheries management agency to review information and give advice. Members are usually not scientists, but most are familiar with the fishing industry or a particular fishery.

Age Frequency or Age Structure - A breakdown of the different age groups of a kind of fish in a population or sample.

Allocation - Distribution of the opportunity to fish among user groups or individuals. The share a user group gets is sometimes based on historic harvest amounts.

Allowable Biological Catch (ABC) - A term used by a management agency which refers to the range of allowable catch for a species or species group. It is set each year by a scientific group created by the management agency. The agency then takes the ABC estimate and sets the annual total allowable catch (TAC).

Anadromous - Fish that migrate from saltwater to fresh water to spawn.

Angler - A person catching fish or shellfish with no intent to sell. This includes people releasing the catch.

Annual Mortality (A) - The percentage of fish dying in one year due to both fishing and natural causes.

Aquaculture - The raising of fish or shellfish under some controls. Ponds, pens, tanks or other containers may be used. Feed is often used. A hatchery is also aquaculture but the fish are released before harvest size is reached.

Artisanal Fishery - Commercial fishing using traditional or small scale gear and boats.

Availability - Describes whether a certain kind of fish of a certain size can be caught by a type of gear in an area.

B

Bag Limit - The number and/or size of a species that a person can legally take in a day or trip. This may or may not be the same as a possession limit.

Benthic - Refers to animals and fish that live on or in the water bottom.

Billfishes - The family of fish that includes marlins, sailfish and spearfish.

Biomass - The total weight or volume of a species in a given area.

Bony Fishes - Fish that have a bony skeleton and belong to the class Osteichthyes. Basically, this is all fish except for sharks, rays, skates, hagfish and lampreys.

Bycatch - The harvest of fish or shellfish other than the species for which the fishing gear was set. Examples are blue crabs caught in the shrimp trawls or sharks caught on a tuna longline. Bycatch is also often called incidental catch. Some bycatch is kept for sale.

C

C/E - See catch per unit of effort.

CPUE - See catch per unit of effort.

Catadromous - Fish that migrate from fresh water to saltwater to spawn.

Catch - The total number or poundage of fish captured from an area over some period of time. This includes fish that are caught but released or discarded instead of being landed. The catch may take place in an area different from where the fish are landed. Note: Catch, harvest and landings are different terms with different definitions.

Catch Curve - A breakdown of different age groups of fish, showing the decrease in numbers of fish caught as the fish become older and less numerous or less available. Catch curves are often used to estimate total mortality.

Catch Per Unit of Effort (CPUE;C/E) - The number of fish caught by an amount of effort. Typically, effort is a combination of gear type, gear size, and length of time gear is used. Catch per unit of effort is often used as a measurement of relative abundance for a particular fish.

Catch Stream - The catch statistics for a kind or stock of fish over a period of time.

Catchability Coefficient (q) - The part of a stock that is caught by a defined unit of effort.

Charter Boat - A boat available for hire, normally by a group of people for a short period of time. A charter boat is usually hired by anglers.

Coastal Migratory Pelagic Fishes - Several species of fish that live in open waters near the coast, grouped together by the Gulf of Mexico Fishery Management Council and South Atlantic Fishery Management Council for management purposes. This includes king and Spanish mackerel, cobia, dolphin and little tunny.

Cohort - A group of fish spawned during a given period, usually within a year.

Cohort Analysis - See virtual population analysis.

Commercial Fishery - A term related to the whole process of catching and marketing fish and shellfish for sale. *It refers to and includes fisheries resources, fishermen, and related business directly or indirectly involved in harvesting, processing, or sales.

Common Property Resource - A term that indicates a resource owned by the public. It can be fish in public waters, trees on public land, and the air. The government regulates the use of a common property resource to ensure its future benefits.

Compensatory Growth - An increase in growth rate shown by fish when their populations fall below certain levels. This may be caused by less competition for food and living space.

Compensatory Survival - A decrease in the rate of natural mortality (natural deaths) that some fish show when their populations fall below a certain level. This may be caused by less competition for food and living space.

Condition - A mathematical measurement of the degree of plumpness or general health of a fish or group of fish.

Confidence Interval - The probability, based on statistics, that a number will be between an upper and lower limit.

***Controlled Access** - See limited entry.

Council - Indicates a regional fishery management group. The Fishery Conservation and Management Act of 1976 as amended created the regional councils. For example, the Gulf of Mexico Fishery Management Council develops fishery policies designed to manage those species most often found in Gulf federal waters.

Crustacean - A group of freshwater and saltwater animals having no backbone, with jointed legs and a hard shell made of chitin. Includes shrimp, crabs, lobsters, and crayfish.

Cumulative Frequency Distribution - A chart showing the number of animals that fall into certain categories, for example, the number of fish caught that are less than one pound, less than three pounds, and more than three pounds. A cumulative frequency distribution shows the number in a category, plus the number in previous categories.

D

Demersal - Describes fish and animals that live near water bottoms. Examples are flounder and croaker.

Directed Fishery - Fishing that is directed at a certain species or group of species. This applies to both sport fishing and commercial fishing.

Disappearance (Z') - Measures the rate of decline in numbers of fish caught as fish become less numerous or less available. Disappearance is most often calculated from catch curves.

E

EEZ - See exclusive economic zone.

EIS - See environmental impact statement.

ESO - See economics and statistics office.

Economic Efficiency - In commercial fishing, the point at which the added cost of producing a unit of fish is equal to what buyers pay. Producing fewer fish would bring the cost lower than what buyers are paying. Producing more fish would raise the cost higher than what buyers are paying. Harvesting at the point of economic efficiency produces the maximum economic yield. See maximum economic yield and economic rent.

Economic Overfishing - A level of fish harvesting that is higher than that of economic efficiency; harvesting more fish than necessary to have maximum profits for the fishery.

Economic Rent - The total amount of profit that could be earned from a fishery owned by an individual. Individual ownership maximizes profit, but an open entry policy usually results in so many fishermen that profit higher than opportunity cost is zero. See maximum economic yield.

Economics and Statistics Office (ESO) - A unit of the National Marine Fisheries Service (NMFS) found in the regional director's office. This unit does some of the analysis required for developing fishery policy and management plans

Effort - The amount of time and fishing power used to harvest fish. Fishing power includes gear size, boat size, and horsepower.

Elasmobranch - Describes a group of fish without a hard bony skeleton, including sharks, skates, and rays.

Electrophoresis - A method of determining the genetic differences or similarities between individual fish or groups of fish by using tissue samples.

Environmental Impact Statement (EIS) - An analysis of the expected impacts of a fisheries management plan (or some other proposed action) on the environment.

Escapement - The percentage of fish in a particular fishery that escape from an inshore habitat and move offshore, where they eventually spawn.

Euryhaline - Fish that live in a wide range of salinities.

Ex-vessel - Refers to activities that occur when a commercial fishing boat lands or unloads a catch. For example, the price received by a captain for the catch is an ex-vessel price.

Exclusive Economic Zone (EEZ) - All waters from the seaward boundary of coastal states out to 200 natural miles. This was formerly called the Fishery Conservation Zone.

F

F - See fishing mortality.

Fmax - The level of fishing mortality (rate of removal by fishing) that produces the greatest yield from the fishery.

FCMA - See Fishery Conservation and Management Act

FCZ - See fishery conservation zone.

FMC - See fishery management council.

FMP - See fishery management plan.

Fecundity - A measurement of the egg-producing ability of a fish. Fecundity may change with the age and size of the fish.

Fishery Conservation and Management Act - The federal law that created the regional councils and is the federal government's basis for fisheries management in the EEZ. Also known as the Magnuson Act after a chief sponsor, Senator Warren Magnuson of Washington.

Fishery - All the activities involved in catching a species of fish or a group of species.

Fishery Conservation Zone (FCZ) - The area from the seaward limit of state waters out to 200 miles. The term is used less often now than the current term, exclusive economic zone.

Fishery Dependent Data - Data collected on a fish or fishery from sport fishermen, commercial fishermen, and seafood dealers.

Fishery Independent Data - Data collected on a fish by scientists who catch the fish themselves, rather than depending on fishermen and seafood dealers.

Fishery Management Council (FMC) - See council

Fishery Management Plan (FMP) - A plan to achieve specified management goals for a fishery. It includes data, analyses, and management measures for a fishery.

Fishing Effort - See effort.

Fishing Mortality (F) - A measurement of the rate of removal of fish from a population by fishing. Fishing mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year. Instantaneous is that percentage of fish dying at any one time. The acceptable rates of fishing mortality may vary from species to species.

Fork Length - The length of a fish as measured from the tip of its snout to the fork in the tail.

G

GLM - See general linear model.

GSI - See gonosomatic index.

General Linear Model (GLM) - A mathematical formula that relates one biological factor to another. Once a mathematical relationship is established, scientists use the formula to predict one factor over another.

Gonosomatic Index (GSI) - The ratio of the weight of a fish's eggs or sperm to its body weight. This is used to determine the spawning time of a species of fish.

Groundfish - A species or group of fish that lives most of its life on or near the sea bottom.

Growth - Usually an individual fish's increase in length or weight with time. Also may refer to the increase in numbers of fish in a population with time.

Growth Model - A mathematical formula that describes the increase in length or weight of an individual fish with time.

Growth Overfishing - When fishing pressure on smaller fish is too heavy to allow the fishery to produce its maximum poundage. Growth overfishing, by itself, does not affect the ability of a fish population to replace itself.

H

Harvest - The total number or poundage of fish caught and kept from an area over a period of time. Note that landings, catch, and harvest are different.

Head Boat - A fishing boat that takes recreational fishermen out for a fee per person. Different from a charter boat in that people on a head boat pay individual fees as opposed to renting the boat.

Histogram - A method of showing data in a graph. The data appears as bars running up and down (vertical) or sideways (horizontal).

I

ITQ - See individual transferable quota.

Incidental Catch - See bycatch.

Individual Transferable Quota - A form of limited entry that gives private property rights to fishermen by assigning a fixed share of the catch to each fisherman.

Industrial Fishery - A fishery for species not directly used for human food. An example is menhaden.

Instantaneous Mortality - See fishing mortality, natural mortality, and total mortality.

Intrinsic Rate of Increase (z) - The change in the amount of harvestable stock. It is estimated by recruitment increases plus growth minus natural mortality.

Isopleth - A method of showing data on a graph which is commonly used in determining yield-per-recruit.

J

Juvenile - A young fish or animal that has not reached sexual maturity.

L

Landings - The number or poundage of fish unloaded at a dock by commercial fishermen or brought to shore by recreational fishermen for personal use. Landings are reported at the points at which fish are brought to shore. Note that landings, catch, and harvest define different things.

Latent Species - A species of fish that has the potential to support a directed fishery.

Length Frequency - A breakdown of the different lengths of a kind of fish in a population or sample.

Length-Weight Relationship - Mathematical formula for the weight of a fish in terms of its length. When only one is known, the scientist can use this formula to determine the other.

Limited Entry - A program that changes a common property resource like fish into private property for individual fishermen. License limitation and the individual transferable quota (ITQ) are two forms of limited entry.

M

mm - See millimeter.

M - See natural mortality.

MEY - See maximum economic yield.

MRFSS - See marine recreational fishery statistics survey.

Magnuson Act - See Fishery Conservation and Management Act.

Mariculture - The raising of marine finfish or shellfish under some controls. Ponds, pens, tanks, or other containers may be used, and feed is often used. A hatchery is also mariculture but the fish are released before harvest size is reached.

Marine Mammal - Animals that live in marine waters and breathe air directly. These include porpoises, whales and seals.

Marine Recreational Fishery Statistics Survey (MRFSS) - An annual survey by the National Marine Fisheries Service (NMFS) to estimate the number, catch, and effort of recreational fishermen. It serves as a basis for many parts of fisheries management plans.

Mark-Recapture - The tagging and releasing of fish to be recaptured later in their life cycles. These studies are used to study fish movement, migration, mortality, and growth, and to estimate population size.

Maximum Economic Yield (MEY) - This is the total amount of profit that could be earned from a fishery if it were owned by an individual. An open entry policy usually results in so many fishermen that profit higher than opportunity cost is zero. See economic rent.

Maximum Sustainable Yield (MSY) - The largest average catch that can be taken continuously (sustained) from a stock under average environmental conditions. This is often used as a management goal.

Mean - Another word for the average of a set of numbers. Simply add up the individual numbers and then divide by the number of items.

Meristics - A series of measurements on a fish, such as scale counts, which are used to separate different populations or races of fish.

Millimeter (mm) - Metric measurement of length 1/25 of an inch long.

Model - In fisheries science, a description of something that cannot be directly observed. Often a set of equations and data used to make estimates.

Mollusk - A group of freshwater and saltwater animals with no skeleton and usually one or two hard shells made of calcium carbonate. Includes the oyster, clam, mussel, snail, conch, scallop, squid, and octopus.

Morphometrics - The physical features of fish, for example, coloration. Morphometric differences are sometimes used to identify separate fish populations.

Multiplier - A number used to multiply a dollar amount to get an estimate of economic impact. It is a way of identifying impacts beyond the original expenditure. It can also be used with respect to income and employment.

N

NMFS - See National Marine Fisheries Service

National Marine Fisheries Service (NMFS) - A federal agency - with scientists, research vessels, and a data collection system - responsible for managing the nation's saltwater fish. It oversees the actions of the Councils under the Fishery Conservation and Management Act.

National Standards - The Fishery Conservation and Management Act requires that a fishery management plan and its regulations meet seven standards. The seven standards were developed to identify the nation's interest in fish management.

Natural Mortality (M) - A measurement of the rate of removal of fish from a population from natural causes. Natural morality can be reported as either annual or instantaneous. Annual mortality is the percentage of this fish dying in one year. Instantaneous is the percentage of fish dying at any one time. The rates of natural mortality may vary from species to species.

Nursery - The part of a fish's or animal's habitat where the young grow up.

O

OY - See advisory panel.

P

Pelagic - Refers to fish and animals that live in the open sea, away from the sea bottom.

Population Dynamics - The study of fish populations and how fishing mortality, growth, recruitment, and natural morality affect them.

Possession Limit - The number and/or size of a species that a person can legally have at any one time. Refers to commercial and recreational fishermen. A possession limit generally does not apply to the wholesale market level and beyond.

Predator - A species that feeds on other species. The species being eaten is the prey.

Predator-Prey Relationship - The interaction between a species that eats (predator) another species (prey). The stages of each species' life cycle and the degree of interaction are important factors.

Prey - A species being fed upon by other species. The species eating the other is the predator.

Primary Productivity - A measurement of plant production that is the start of the food chain. Much primary productivity in marine or aquatic systems is made up of phytoplankton, which are tiny one-celled algae that float freely in the water.

Pulse Fishing - Harvesting a stock of fish, then moving on to other stocks or waiting until the original stock recovers.

Put and Take Fishery - The placing of hatchery-raised fish in waters to be caught by fishermen. There are few marine fisheries that fit this description. Most cases are found in inland streams and lakes.

Q

q - See catchability coefficient.

Quota - The maximum number of fish that can be legally landed in a time period. It can apply to the total fishery or an individual fisherman's share under the ITQ system. Could also include reference to size of fish.

R

RD - See regional director.

RIR - See regulatory impact review.

Recreational Fishery - Harvesting fish for personal use, fun, and challenge. Recreational fishing does not include sale of catch. *The term refers to and includes the fishery resources, fishermen, and businesses providing needed good and services.

Recruit - An individual fish that has moved into a certain class, such as the spawning class or fishing-size class.

Recruitment - A measure of the number of fish that enter a class during some time period, such as the spawning class or fishing-size class.

Recuitment Overfishing - When fishing pressure is too heavy to allow a fish population to replace itself.

*Added by Wallace et al.

Reef Fish Complex - A term used by the Gulf of Mexico Fishery Management Council to describe the many species of fish found around natural reefs, artificial reefs, ledges, and mud lumps. Snapper, grouper, and tilefish are examples.

Regional Director (RD) - The person in charge of the National Marine Fisheries Service (NMFS) for a given region.

Regression Analysis - A statistical method to estimate any trend that might exist among important factors. An example in fisheries management is the link between catch and other factors like fishing effort and natural mortality.

Regulatory Impact Review (RIR) - The part of a federal fishery management plan that describes impacts resulting from the plan.

Relative Abundance - An index of fish population abundance used to compare fish populations from year to year. This does not measure the actual numbers of fish, but shows changes in the population over time.

Rent - See economic rent.

S

s - See survival rate.

SAFE - See stock assessment and fishery evaluation report.

SEFC - See Southeast Fisheries Center.

SPR - See spawning potential ratio.

SSBR - See spawning stock biomass per recruit.

SSC - See scientific and statistical advisory committee.

Scattergram - A graph that shows how factors relate to each other. This is visual, not statistical, and is used when it is necessary to compare two factors, like fish age and size.

Scientific Assessment Panel - A group of biologists, economists, and sociologists put together by a federal fishery management council to review scientific data on the condition of a stock of fish and the interests of the fishermen and seafood processors who use the stock. Panel members generally come from universities and state and federal fisheries agencies.

Scientific and Statistical Advisory Committee - A group of scientific and technical people giving advice to a council.

Secretarial Management Plan - A term used to describe a plan developed by the Secretary of the U.S. Department of Commerce in response to an emergency, a council's failure to act, *or for highly migratory species.

Selectivity - The ability of a type of gear to catch a certain size or kind of fish, compared with its ability to catch other sizes or kinds.

Simulation - An analysis that shows the production and harvest of fish using a group of equations to represent the fishery. It can be used to predict events in the fishery if certain factors changed.

Size Distribution - A breakdown of the number of fish of various sizes in a sample or catch. The sizes can be in length or weight. This is mot often shown on a chart.

***Shellfish** - General term for crustaceans and mollusks.

Slot Limit - A limit on the size of fish that may be kept. Allows a harvester to keep fish under a minimum size and over a maximum size, but not those in between the minimum and maximum. *Can also refer to size limits that allow a harvester to keep only fish that fall between a minimum and maximum size.

Social Impacts - The changes in people, families, and communities resulting from a fishery management decision.

Socioeconomics - A word used to identify the importance of factors other than biology in fishery management decisions. For example, if management results in more fishing income, it is important to know how the income is distributed between small and large boats or part-time and full-time fishermen.

Southeast Fisheries Center (SEFC) - Headquarters for the scientific staff of the National Marine Fisheries Service (NMFS) in the South Atlantic and Gulf of Mexico states. The center is located in Miami, Florida, with smaller laboratories at several other locations.

Spawner-Recruit Relationship - The concept that the number of young fish (recruits) entering a population is related to the number of parent fish (spawners).

Spawning Potential Ration (SPR) - *The number of eggs that could be produced by an average recruit in a fished stock divided by the number of eggs that could be produced by an average recruit in an unfished stock. SPR can also be expressed at the spawning stock biomass per recruit (SSBR) of a fished stock divided by the SSBR of the stock before it was fished.

Spawning Stock Biomass - The total weight of the fish in a stock that are old enough to spawn.

Spawning Stock Biomass Per Recruit (SSBR) - *The spawning stock biomass divided by the number of recruits to the stock or how much spawning biomass an average recruit would be expected to produce.

Species - A group of similar fish that can freely interbreed.

Sport Fishery - See recreational fishery.

Standard Length - The length of a fish as measured from the tip of the snout to the hidden base of the tail fin rays.

Standing Stock - See biomass.

Stock - A grouping of fish usually based on genetic relationship, geographic distribution, and movement patterns. *Also a manageed unit of fish.

Stock Assessment Group - A group of scientists, skilled in the study of fish population dynamics put together by a federal fishery management council to review the scientific data on the condition of a stock of fish. The scientists generally come from universities and state and federal fisheries agencies.

Stock Assessment and Fishery Evaluation Report (SAFE) - A report that provides a summary of the most recent biological condition of a stock of fish and the economic and social condition of the recreational fishermen, commercial fishermen, and seafood processors who use the fish. The report provides information to the federal fishery management councils for determining the harvest levels.

Stock-Recruit Relationship - See spawner-recruit relationship.

Stressed Area - An area in which there is special concern regarding harvest, perhaps because the fish are small or because harvesters are in conflict.

Surplus Production Model - A model that estimates the catch in a given year and the change in stock size. The stock size could increase or decrease depending on new recruits and natural mortality. A surplus production model estimates the natural increase in fish weight or the sustainable yield.

Survival Rate(s) - The number of fish alive after a specified time, divided by the number alive at the beginning of the period.

T

TAC - See total allowable catch.

TIP - See trip interview program.

Territorial Sea - The area from average low-water mark on the shore out to three miles for the states of Louisiana, Alabama, and Mississippi, and out to nine miles for Texas and the west coast of Florida. The shore is not always the baseline from which the three miles are measured. In such cases, the outer limit can extend further than three miles from the shore.

Total Allowable Catch (TAC) - The annual recommended catch for a species or species group. The regional council sets the TAC from the range of the allowable biological catch.

Total Length - The length of a fish as measured from the tip of the snout to the tip of the tail.

Total Mortality (Z) - A measurement of the rate of removal of fish from a population by both fishing and natural causes. Total mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year. Instantaneous mortality is that percentage of fish dying at any one time. The rate of total mortality may vary from species to species.

Trip Interview Program (TIP) - *A cooperative state-federal commercial fishery dependent sampling activity conducted in the Southeast region of NMFS, concentrating on size and age information for stock assessments of federal, interstate, and state managed species. TIP also provides information on the species composition, quantity, and price for market categories, and catch-per-unit effort for individual trips that are sampled.

U

Underutilized Species - A species of fish that has potential for large additional harvest.

Unit Stock - A population of fish grouped together for assessment purposes which may or may not include all the fish in a stock.

V

VPA - See virtual population analysis.

Virgin Stock - A stock of fish with no commercial or recreational harvest. A virgin stock changes only in relation to environmental factors and its own growth, recruitment, and natural mortality.

Virtual Population Analysis (VPA) - A type of analysis that uses the number of fish caught at various ages or lengths and an estimate of natural mortality to estimate fishing mortality in a cohort. It also provides an estimate of the number of fish in a cohort at various ages.

Y

Year-Class - The fish spawned and hatched in a given year, a "generation" of fish.

Yield - The production from a fishery in terms of numbers or weight.

Yield Per Recruit - A model that estimates yield in terms of weight, but more often as a percentage of the maximum yield, for various combinations of natural mortality, fishing mortality and time exposed to the fishery.

Z

z - See intrinsic rate of increase.

Z - See total mortality.

Z' - See disappearance.