ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

BIOLOGICAL OPINION

Agency: National Marine Fisheries Service, Northeast Region

Activity: Endangered Species Act Section 7 Consultation on the Federal Atlantic Mackerel, Squid and Atlantic Butterfish Fishery Management Plan (FMP)

Conducted by: National Marine Fisheries Service
Northeast Regional Office through its Protected Resource Division
F/NER/2008/09091
GARFO-2008-00005

Date Issued: OCT 29 2010

Approved by: [signature]

TABLE OF CONTENTS

Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.) requires that each federal agency ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a federal agency may affect species listed as threatened or endangered, that agency is required to consult with either the NOAA's National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (FWS), depending upon the species that may be affected. In instances where NMFS or FWS are themselves proposing an action that may affect listed species, the agency must conduct intra-service consultation. Since the action described in this document is proposed to be authorized by NMFS Northeast Region (NERO), this office has requested formal intra-service Section 7 consultation with NMFS NERO Protected Resources Division.

NMFS NERO has reinitiated formal intra-service consultation, in accordance with Section 7(a)(2) of the ESA, and 50 CFR 402.16 given that information indicated that a listed species, loggerhead sea turtle, may be affected in a manner or to an extent not previously considered. This document represents NMFS' biological opinion (Opinion) on the continued implementation of the Atlantic Mackerel, Squid and Atlantic Butterfish Fishery Management Plan (MSB FMP), and its effects on ESA-listed species under NMFS jurisdiction in accordance with Section 7 of the Endangered Species Act of 1973, as amended.

In 2008 Murray published a NEFSC Reference Document where she used Vessel Trip Report (VTR) data from 2000-2004 to model and formulate an average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in Mid-Atlantic fisheries. Murray was able to segregate bycatch in many FMP fisheries and for the MSB fishery she estimated the annual bycatch to be 62 loggerhead sea turtles. This new information was not available and therefore not considered as part of the last MSB biological opinion and consultation was reinitiated so that this new loggerhead sea turtle data could be analyzed.

Formal intra-service Section 7 consultation on the continued implementation of the MSB FMP was reinitiated on March 6, 2008 [Consultation No. F/NER/2008/09091]. This Opinion is based on the information developed by NMFS' NERO Sustainable Fisheries Division and other sources of information.

1.0 CONSULTATION HISTORY

Formal consultation on the MSB FMP was conducted in the context of the consultation on all fisheries for the Marine Mammal Exemption Program (MMEP). An Opinion with an Incidental Take Statement (ITS) for all fisheries was issued on July 5, 1990. Subsequently, NMFS completed informal consultations for Amendment 4 (August 6, 1991), Amendment 5 (February 16, 1995), and Amendment 6 (August 15, 1995) to the FMP. Due to the low level of incidental take of endangered or threatened species in the fishery, formal consultation was not initiated for this fishery independently of the MMEP consultation and no separate ITS was issued. NMFS became aware of possible sea turtle interactions by vessels targeting mackerel and/or squid while considering Amendment 8 actions.

The last formal Opinion on the MSB fishery was conducted during the normal regulatory review process to implement Amendment 8 on the FMP and was completed April 28, 1999. The April 28, 1999, Opinion for the MSB fishery concluded that the continued operation of the fishery was not likely to result in jeopardy to any ESA-listed species under the jurisdiction of NMFS (NMFS 1999).

However, sea turtles and shortnose sturgeon were expected to experience harassment, injury, or mortality due to interactions with the gear used in this fishery. Interactions with MSB fishing gear can include capture, entanglement, or hooking. In accordance with ESA regulations (50 CFR 402.02), such interactions are considered "incidental takes." An Incidental Take Statement (ITS) was provided with the April 28, 1999 Opinion along with non-discretionary Reasonable and Prudent Measures (RPMs) to minimize the impact of incidental take. As described in the ITS, up to 6 loggerhead sea turtles (no more than 3 lethal), 2 (lethal or non-lethal) Kemp's ridley sea turtles, 2 (lethal or non-lethal) green sea turtles, 1 (lethal or non-lethal) leatherback sea turtle and 3 shortnose sturgeon (no more than 1 lethal) were anticipated to be taken annually as a result of the continued authorization of the MSB fishery (NMFS 1999).

In the intervening years since the introduction of the FMP, MSB fishery management regulations have remained relatively constant with little change until Amendment 9 was passed in 2009. Each year an annual specification package allocates fishing quota (multi year specifications were part of Amendment 9) for the upcoming year, so that the fishery may continue and remain within framework management guidelines and the required quota specifications, as described in the FMP.

In addition to the 1999 formal consultation, informal Section 7 consultations were conducted and completed for Amendment 9 and Amendment 10 (2009). These informal consultations concluded that the proposed Amendments either had no effect on or might affect, but was not likely to adversely affect, ESA-listed species under NMFS jurisdiction or designated critical habitat. Consultations have been conducted on annual specification packages since the 1999 BO. These consultations have all been informal, and the last informal consultation was completed on October 13th, 2009 which analyzed the annual specifications for all species managed under the FMP for the year 2010.

Date of Documented Management Actions

1998 Amendment 8
• Brought the FMP into compliance with new and revised National Standards and other required provisions of the Sustainable Fisheries Act
• Added a framework adjustment procedure

2003 Framework 3
• Extended the moratorium on entry to the *Illex* fishery

2004 Framework 4
• Extended the moratorium on entry to the *Illex* fishery for an additional five years

2009 Amendment 9

• Allowed multi-year specifications for all species managed under the FMP
• Maintained the moratorium on entry into *Illex* fishery
• Revised the biological reference points for *Loligo*
• Designated Essential Fish Habitat (EFH) for *Loligo pealeii* eggs
• Reduced gear impacts to EFH
• Created a quota set-aside for scientific research
• Established that previous year specifications apply when specifications for the management unit are not published prior to the start of the fishing year (excluding TALFF specifications)
• Allowed for the specification of management measures for *Loligo* for a period of up to three years

2010 Amendment 10

• Implemented a butterfish stock rebuilding program with a butterfish mortality cap for the Loligo fishery
• Requires an annual assessment of the butterfish rebuilding program by the Council's Scientific and Statistical Committee (SSC)
• Increased the minimum codend mesh size requirement for the Loligo fishery from 1⅞ inches to 2⅛ inches
• Established a 72-hour trip notification requirement for the Loligo fishery

Cause for Reinitiation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and: (1) a new species is listed that may be affected by the action not considered in the opinion; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered;
(3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in the opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

The anticipated incidental take of loggerhead, Kemp's ridley, green and leatherback sea turtles, and shortnose sturgeon in MSB fishing gear exempted by the April 28, 1999 Opinion was based on observed interactions from sea sampling data for gear types targeting or capable of catching MSB (NMFS 1999). The MSB fishery is known to interact with sea turtles, given the time and locations where the fishery occurs. Although no incidental takes of ESA-listed loggerhead, leatherback, Kemp's ridley, or green sea turtles have been reported in bottom otter trawl gear for trips that were 'targeting' mackerel, or butterfish (where the top species landed was mackerel, shortfin squid and butterfish), incidental takes of loggerhead, leatherback and green sea turtles have been observed in bottom otter trawl gear where *Loligo*, Atlantic longfin squid and *Illex,* Atlantic shortfin squid (constituted greater than 50% of the catch (NMFS 1999, Murray 2006, Murray 2008).

In August 2007, NMFS received an estimate of loggerhead sea turtle bycatch in bottom otter trawl gear used in the MSB fishery (Memo from K. Murray, Northeast Fisheries Science Center [NEFSC] to L. Lankshear, NERO, Protected Resources Division [PRD]). This information has since been published in a 2008 NEFSC Reference Document (Murray 2008). Using Vessel Trip Report (VTR) data from 2000-2004 and the average annual bycatch of sea turtles as described in Murray (2006), the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the MSB fishery was estimated to be 62 loggerhead sea turtles per year.

The April 28, 1999 Opinion on the continued authorization of the MSB FMP anticipated the annual incidental take of 6 loggerhead sea turtles. At the time of its publication, the information presented by Murray (2006) represented new information on the effects of the MSB fishery on loggerheads. Therefore, in accordance with the regulations at 50 CFR 402.16, formal consultation was reinitiated on March 6, 2008 to reconsider the effects of the fishery on ESA-listed sea turtles, including loggerheads, leatherbacks, Kemp's ridleys, and green sea turtles. Murrays 2008 paper outlined in more detail the average annual bycatch of loggerhead sea turtles by Federal or Interstate Fishery Management Plan (FMP) and VTR data effort from 2000-2004. This updated paper provided more comprehensive information in a much more useful format for fisheries and FMP management needs (Murray 2008). This new loggerhead sea turtle bycatch information will be incorporated by reference.

2.0 DESCRIPTION OF THE PROPOSED ACTION

As stated, the last formal Opinion for the MSB fishery was completed April 28, 1999. In the intervening period, information has been provided by NEFSC on an estimated otter trawl bycatch for loggerhead sea turtles in Mid-Atlantic waters by FMP (Murray 2008). This new sea turtle bycatch estimate from gears used in the MSB fishery was not available and therefore not considered in the 1999 Opinion. The present opinion will consider and analyze possible risk posed to sea turtles and other ESA-listed species from fishing gear used in the execution of the MSB fishery.

It is important to note that commercial and recreational fishing vessels are often permitted to operate within multiple federal fisheries and species of fish managed under multiple FMPs are commonly landed concurrently, for the purposes of this Opinion, fishing effort under the MSB FMP includes actions that result in landings of mackerel, squid and butterfish by federally permitted vessels operating within the action area described below in Section 2.1-2.3. In order to identify and analyze fishery impacts on protected species, ideally, documented takes of listed species would be linked to FMPs proportionally based on the fish catch composition of the fishing trip. As an example, fishing effort and estimated bycatch of ESA-listed species for a trip that landed 40% spiny dogfish, 35% haddock (a species managed under the Multispecies FMP) , and 25% monkfish would be allocated proportionately to the Spiny Dogfish FMP (40%), Multispecies FMP (35%), and Monkfish FMP (25%). The overall estimated bycatch for each FMP is the sum of the proportionally allocated bycatch estimates.

However, data on take of protected species does not currently completely align with this ideal definition of the fishery. We have the benefit of scientifically produced estimates of loggerhead sea turtle bycatch in commercial trawl and gillnet fisheries pertaining to the action area considered in this consultation (Murray 2008 and Murray 2009a). The bycatch estimate for trawl fisheries attributes takes to the most abundant (by weight) fish species (which are used as a proxy for associated FMPs) landed per trip. Alternatively, the gillnet loggerhead bycatch estimate is more closely aligned with our ideal definition of the fishery as it proportionally attributes sea turtle takes consistent with the composition of the fish catch for that trip. For leatherback, Kemp's ridley, and green sea turtles observed takes of sea turtles are attributed to the FMP that covers the species which makes up the majority (by weight) of the catch for the trip during which sea turtle(s) were caught. The number of observed non loggerhead sea turtle takes attributable to a specific fishery is a small sample size. Given that we know these are underestimates since they are a tally of observations rather than an overall estimate, we have selected to use the total number of leatherback, Kemp's ridley and green sea turtle takes by species and gear type as the estimated take level. While this may attribute the same take of a turtle to multiple fisheries and in that way over count that individual take, this is offset by the fact that the number of observed takes is less than the number of actual takes occurring in the fishery. For listed large whales, we can only rarely attribute takes to a specific fishery. We, therefore, attribute takes by gear type and assume that any one of the fishery management plans that authorize the use of that gear may be responsible for that take.

The proposed action is NMFS' continued authorization of the MSB fishery managed under the MSB FMP, consistent with all applicable regulations. The management unit for the MSB FMP is defined as the Atlantic MSB resource throughout the range of the species within the U. S. waters of the northwest Atlantic Ocean from the shoreline to the seaward boundary of the exclusive economic zone (EEZ). A summary of the characteristics of the fishery relevant to the analysis of its potential effects on threatened and endangered species is presented below.

A. Description of the Historical and Current Fishery for Atlantic Mackerel, Squid and Atlantic Butterfish

Historical Fishery

Species managed under the FMP include Atlantic mackerel, *Scomber scombrus*; short-finned squid, *Illex illecebrosus*; long-finned squid, *Loligo pealeii*; and Atlantic butterfish, *Peprilus triacanthus*. The most recent description of the fisheries can be found in the Amendment 10 environmental impact statement (EIS) document (MAFMC, June 2009). Status of these fishery resources is summarized in this document and in the EIS for Amendment 9. All four of the fishery stocks managed within this FMP are migratory and transboundary with Canada, so Canadian fishing effort may influence the status of the stocks in U.S. waters. Although separate biological stocks for some of the species may exist, insufficient information is available to support separate stocks and the FMP is designed around one stock per species. Further investigation of stock definition has been recommended.

The modern northwest Atlantic mackerel fishery began with the arrival of the European distant-water fleets (DWF) in the early 1960's. Total international commercial landings (NAFO

Subareas 2-6,) peaked at 437,000 mt in 1973 and then declined sharply to 77,000 mt by 1977 (Overholtz 1989). The Magnuson-Stevens Act (MSA) established control of the portion of the mackerel fishery occurring in US waters (NAFO Subareas 5-6) under the auspices of the 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 the MSA the foreign mackerel fishery was restricted by NOAA Foreign Fishing regulations to certain areas or "windows." Under the MSB FMP 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 before being phased out again.

Illex and *Loligo* squid fisheries are dominated by small-mesh otter trawls during the spring and summer months (Clark 1998). The Atlantic mackerel fishery is prosecuted by both mid-water (pelagic) and bottom trawls. The vast majority of butterfish landings come from bottom otter trawl fishing. Unlike the other resources managed through this FMP, landings of butterfish are generally a result of bycatch in other directed fisheries. There is no real directed butterfish fishery. Butterfish are landed as a bycatch in the directed *Loligo* fishery. Therefore, the gears and timing as outlined and described above, hold true for butterfish.

Recent Fishery

U.S. commercial landings of mackerel increased steadily from roughly 3,000 mt in the early 1980s to greater than 31,000 mt by 1990. US mackerel landings declined to relatively low levels 1992-2000 before increasing in the early 2000's. The most recent year (2007) saw a significant drop-off in harvest (50% drop from 2006, see Table 1), and preliminary 2008 data suggested that 2008 will be similar to 2007 (MAFMC 2009).

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

Multiple gear types are used in the MSB fishery including bottom otter trawl, mid-water trawl, single and paired trawl and, those with minimal participation include hand lines, rod and reel, traps/pots, and gillnet (NMFS 2007). Bottom otter trawl and mid-water trawl represent the dominant gear type as indicated on permits for the 2007 MSB fishing year (NMFS 2008). Other gear types which may be used in the MSB fishery include pelagic longline/hook-and line/handline, pot/trap, dredge, pound net, gillnet, and bandit gear.

Other gears in the MSB fishery, including weirs and gillnets are a small percentage of total fishing gears used within the MSB fishery (1-2 per cent of landings). There have been no observed confirmed take of sea turtles from these minor MSB gears. Sea turtle take has occurred and has been recorded in other Atlantic coast gillnet fisheries, regardless of the target species. Some of the interactions with gillnets have been analyzed in other consultations on FMPs including summer flounder, skate, and monkfish. In 2009, Murray estimated bycatch of loggerhead sea turtles in Mid-Atlantic sink gillnet gear (2002-2006). This paper provided estimates of loggerhead bycatch by fish species group, but did not identify the MSB fishery. It groups MSB with forty other fish species ("other species"), which collectively are expected to have three loggerhead sea turtle bycatch interactions per year. Overall, loggerhead bycatch rates in Mid-Atlantic sink gillnet gear are correlated with mesh size, water temperature, and area fished. No predictive bycatch estimates are available for leatherback, green or Kemp's ridley sea turtles in gillnet gear and no observed takes have been documented using this MSB gear in Mid-Atlantic waters.

As previously stated for the other minor gears allowed in the fishery, the effort is relatively small, especially when compared to the fishing effort exerted by all the various trawl gears, used in the fishery (Dealer Database gear effort in the FMP). Some of these gear types may only be used in state waters and therefore not likely to be part of the federal fishery. All these gear types in combination amount to less than 4% of the landings in the fishery (NMFS 2008). There have been no documented takes of ESA-listed sea turtles in the Northeast handline, bottom longline or pot/trap fisheries in 2002-2008 (NEFSC FSB database). Given the absence of observed interactions with the minor gears in the MSB fishery, and the minimal fishing effort involved, NMFS anticipates that takes in this sector of the MSB fisheries would be rare and unlikely and are expected to be insignificant and discountable.

2.1 The Atlantic Mackerel

The bulk of commercial Atlantic mackerel landings occur in the early part of the year from January – April (Clark 1998, Amd 10 Draft EIS). During these months the stock tends to be in shallower water and is more accessible to commercial harvest. An Atlantic mackerel trawl fishery also occurs in the Gulf of Maine during the summer and fall months (May-December) (Clark 1998). Geographically, Atlantic mackerel harvest is widely distributed between Maine and North Carolina. Concentrations of catch occur on the continental shelf southeast of Long Island, NY and east of the Delmarva Peninsula.

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

Fishing mortality based reference points were re-estimated during SARC 42. SARC 42 concluded that the northwest Atlantic mackerel stock is not overfished and overfishing is not occurring. Mackerel are taken with a variety of gears but mostly bottom otter trawl, single midwater trawls, and paired midwater trawls. Landings by gear type as recorded in the NMFS dealer weigh out database 1982-2007 are displayed below in Table 1. Based on NE Dealer weighout database, the vast majority of commercial Atlantic mackerel landings are taken by trawl gear. Among trawl types, unspecified midwater otter trawls and paired midwater trawls have become increasingly important in recent years. From 2002-2006, paired midwater trawls comprised 38% of commercial Atlantic mackerel landings, while unspecified midwater trawls also accounted for 40% of the landings, and bottom otter trawls comprised only 14% of the landings. By comparison, from 1996-2000, paired midwater trawls landings comprised only 2% of the total commercial Atlantic mackerel landings, while unspecified midwater trawls accounted for 22% of the landings, and bottom otter trawls accounted for 71% of the landings. Thus, since 2001 the great majority of mackerel have been landed by single and paired midwater trawls. Landings have varied by year but a constant is that paired trawling takes the greatest quota of mackerel.

Landings by Gear, (Dealer Weighout Data)

Table 1. Mackerel landings by gear type, total landings, quota, percent of quota and Initial Optimum Yield (IOY). IOY is a reduction of Allowable Biological Catch (ABC) that accounts for management uncertainty.

Year	Bottom Otter Trawl	Single Midwater Trawl	Paired Midwater Trawl	Other	Total	Initial Optimum Yield IOY	Percent of IOY Landed
1982	1,908	.	19	744	2,671		
1983	890	.	410	1,342	2,642		
1984	1,235	118	396	1,045	2,795		
1985	1,481	.	249	905	2,635		
1986	3,436	.	2	514	3,951		
1987	3,690	.	0	649	4,339		
1988	5,770	.	0	562	6,332		
1989	7,655	.	0	589	8,245		
1990	8,847	.	0	1,031	9,878		
1991	15,514	564	223	285	16,585		
1992	11,302	.	1	458	11,761		
1993	3,762	479	.	412	4,653		
1994	8,366	1	.	551	8,917	120,000	7%
1995	7,920	50	.	499	8,468	100,000	8%
1996	13,345	1,295	.	1,088	15,728	105,500	15%
1997	13,927	628	.	847	15,403	90,000	17%
1998	12,095	571	1,363	495	14,525	80,000	18%
1999	11,181	99	.	752	12,031	75,000	16%
2000	4,551	736	.	362	5,649	75,000	8%
2001	584	11,396	.	360	12,340	85,000	15%
2002	4,008	11,669	10,477	376	26,530	85,000	31%
2003	5,291	17,212	11,572	222	34,298	175,000	20%
2004	7,329	23,170	20,499	5,440	56,438	170,000	33%
2005	5,437	15,635	18,894	2,242	42,209	115,000	37%
2006	10,359	24,413	19,360	2,509	56,641	115,000	49%
2007	2,097	14,715	8,080	655	25,547	115,000	22%

Atlantic mackerel are caught throughout the New England and Mid-Atlantic region but are generally concentrated off the coast of Delmarva through Rhode Island for the years 1998-2002. From 2003-2007 (the last year we have complete results) of particular note is the reduction in landing activity in these southern areas and the increased landings in the northern states, particularly Massachusetts. Of particular note, Massachusetts now holds three of the top five commercial ports which land mackerel (2008).

2.2 The Illex Fishery

The U.S. domestic fishery for *Illex s*quid, ranging from Southern New England to Cape Hatteras, North Carolina, reflects patterns in the seasonal distribution of *Illex* Squid (*Illex illecebrosus*). Because *Illex* geographical range extends well beyond the US EEZ, *Illex* are subject to exploitation in waters outside the U.S. jurisdiction. During the mid-1970's, a large directed fishery for *Illex* developed in NAFO subareas. *Illex* are harvested offshore (along or outside of the 100-m isobath), mainly by small-mesh otter trawlers, when the squid are distributed in continental shelf and slope waters during the summer months (June-September) (Clark 1998). U.S. landings of *Illex* between 1982 and 2006 have fluctuated from 1,428 mt in 1983 to 26,097 mt in 2004. Over that time period there was a relatively steady increase in landings which peaked in the mid-1990's and more or less steadily declined. Two exceptional years since the mid-1990's peak were 1998 (23,568 mt) and 2004 (26,097 mt), resulting in closures of the directed fishery because the domestic quota was exceeded by 24% and 8.7%, respectively. The vast majority of U.S. commercial landings are taken by bottom otter trawls (see Table 2). The bulk of commercial landings for *Illex* occur between May-October.

The temporal patterns of the *Illex* fisheries in both U.S. and Canadian waters are determined primarily by the timing of the species' feeding migration onto the spawning migration off of the continental shelf, although worldwide squid market conditions also influence the timing of the fishing season in the U.S. EEZ (NEFSC 2003). According to NEFSC (2003), the largest contribution to total *Illex* landings tend to occur along the continental shelf break in depths between 128 and 366 m (70 – 200 fathoms). Although *Illex* are a ubiquitous bait item used in recreational fishing activities, these bait squid are a product of the commercial fishery and are, therefore, already accounted for. There is no directed recreational fishery for *Illex* of any significance.

The most recent stock assessment occurred in 2005 at SAW 42. It was not possible to evaluate current stock status because there are no reliable current estimates of stock biomass or fishing mortality rate. However, based on a number of qualitative analyses, overfishing was not likely to have occurred during 1999-2002.

Table 2. Illex landings by gear type, total landings, quota, percent of quota (Dealer Weighout Data) **and Initial Optimum Yield (IOY). IOY is a reduction of Allowable Biological Catch (ABC) that accounts for management uncertainty.**

YEAR	Bottom Otter Trawl	Other	TOTAL	Initial Optimum Yield IOY	Percent of IOY Landed
1982	3,530	3	3,533		
1983	1,413	16	1,428		
1984	3,287	3	3,290		
1985	2,447	0	2,447		
1986	4,408	1	4,409		
1987	6,468	494	6,962		
1988	1,953	4	1,957		
1989	6,801	0	6,801		
1990	11,315	0	11,316		
1991	11,906	2	11,908		
1992	17,822	5	17,827		
1993	18,012	0	18,012		
1994	17,693	657	18,350		
1995	13,970	6	13,976		
1996	15,690	1,279	16,969		
1997	13,004	352	13,356		
1998	23,219	349	23,568	19,000	124%
1999	7,309	80	7,389	19,000	39%
2000	8,967	44	9,011	24,000	38%
2001	4,009	0	4,009	24,000	17%
2002	2,709	41	2,750	24,000	11%
2003	6,111	280	6,391	24,000	27%
2004	24,428	1,669	26,097	24,000	109%
2005	7,955	4,057	12,011	24,000	50%
2006	13,447	497	13,944	24,000	58%
2007	7,948	1,074	9,022	24,000	38%

2.3 The Loligo Fishery

The latest stock assessment for *Loligo* was conducted at SAW 34 (NEFSC 2002). The current status of the *Loligo* stock is unknown with regard to the stock size threshold. Overfishing was determined not to have been occurring at the time of the assessment, however given the short life span of the species (< 1 year), one cannot assume that current conditions are consistent with those reported in that assessment (NEFSC 2002).

The U.S. domestic fishery for *Loligo* squid (*Loligo pealeii*) occurs mainly in Southern New England and Mid-Atlantic waters. Fishery patterns reflect *Loligo* seasonal distribution, therefore most effort is directed offshore near the edge of the continental shelf during the fall and winter months (October- March) and inshore during the spring and summer months (April-September) (Clark 1998). Long-finned squid are primarily harvested by bottom otter trawl gear, as can be seen from the following table (Table 3).

Table 3. Loligo landings by gear type, total landings, quota, percent of quota (Dealer Weighout Data) **and Initial Optimum Yield (IOY). IOY is a reduction of Allowable Biological Catch (ABC) that accounts for management uncertainty.**

YEAR	Bottom Otter Trawl	Single Midwater Trawl	Dredge (for unknown species)	All others	Total	IOY	Percent of IOY Landed
1982	2,445	0	.	79	2,524		
1983	8,266	.	.	466	8,731		
1984	6,648	.	.	509	7,158		
1985	6,217	.	.	647	6,864		
1986	10,867	.	.	646	11,512		
1987	9,699	.	.	655	10,354		
1988	16,811	.	.	1,751	18,562		
1989	22,416	.	.	1,234	23,650		
1990	14,354	.	.	599	14,954		
1991	18,849	3	.	557	19,409		
1992	17,914	.	.	263	18,177		
1993	21,885	.	.	386	22,272		
1994	22,404	.	.	159	22,563		
1995	17,622	.	.	725	18,348		
1996	11,720	440	.	254	12,414		
1997	15,649	2	.	461	16,113		
1998	18,962	2	.	159	19,123	21,000	91%
1999	18,938	0	.	171	19,109	21,000	91%
2000	17,198	23	.	259	17,480	13,000	134%
2001	14,021	45	.	171	14,238	17,000	84%
2002	16,508	.	.	198	16,707	17,000	98%
2003	11,839	.	.	96	11,935	17,000	70%
2004	12,874	493	364	1,834	15,566	17,000	92%
2005	11,673	1,290	1,037	2,982	16,983	17,000	100%
2006	12,577	333	892	2,105	15,907	17,000	94%
2007	9,990	272	602	1,477	12,342	17,000	73%

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

2.4 The Butterfish Fishery

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

A peak in U.S. commercial butterfish landings (11,300 mt) occurred in 1984. Relatively high landings levels in the 1980s were attributed to heavy demand for butterfish in the Japanese market (NEFSC 2004). Demand from that market has since waned and landings averaged only 2,790 mt during 1990-1999. Since 2001, there has been minimal directed fishing so landings have been very low, ranging from 437-554 mt during 2002-2006. Most landed butterfish are currently caught incidentally when other species, principally squid, are being targeted.

Of the 64,088 individual hauls monitored through the NEFOP from 2001-2006, only 36 hauls (~ 0.06 of one percent) indicated butterfish as the primary target species; yet butterfish were retained on 901 (~ 18%) of the observed trips. As such, it is difficult to characterize the trips that contribute to the majority of butterfish landings. Fisheries with substantial butterfish bycatch include the squid, silver hake, mackerel and mixed groundfish fisheries. Of these fisheries the largest and most consistent bycatch occurs in the small-mesh squid fisheries (NEFSC 2004). Between 2001 and 2006, the *Loligo* fishery was responsible for 68% of butterfish discards.

Atlantic butterfish (*Peprilus triacanthus*) undergo a northerly inshore migration during the summer months, a southerly offshore migration during the winter months, and are mainly caught as bycatch to the directed squid and mackerel fisheries. Fishery Observers suggest that a significant amount of Atlantic butterfish discarding occurs at sea. From 1997-2001 the bulk of the U.S. commercial butterfish landings occur in January-March. More recently 2001-2006, landings have been spread throughout the year (likely due to lack of directed effort). Although low level butterfish harvest is widespread, concentrations of landings come from southern New England shelf break areas near 40° N, as well as in and near Long Island Sound. When compared to the other three species managed by this FMP, the actual fishery for butterfish is minimal. Over the past number of available years (2001-2006) the mean butterfish landings have been very minor (~ 480 mt) annually.

The 49th Northeast Regional Stock Assessment Workshop (SAW 49) results, published in January 2010, provided updated estimates of butterfish fishing mortality and stock biomass. The current status of the butterfish stock is unknown because biomass reference points could not be determined in the SAW 49 assessment. Though the butterfish population appears to be declining over time, fishing mortality does not seem to be the major cause. Butterfish have a high natural mortality rate, and the current estimated fishing mortality rate (F = 0.02) is well below all candidate overfishing threshold reference points. The assessment report noted that predation is likely an important component of the butterfish natural mortality rate (currently assumed to be 0.8), but also noted that estimates of consumption of butterfish by predators appear to be very low. In short, the underlying causes for population decline are unknown.

Summary
As stated above, the federal MSB fishery is primarily a mobile gear fishery using predominantly midwater (both single and paired) and bottom otter trawl gear. The list of allowable commercial gear types authorized under this FMP – in the federal register under the List of Fisheries (64 FR 4030) -- includes trawl, pelagic drift gillnet, pelagic longline, hook-and-line/hand line, purse seine, pot, trap, dredge, and bandit gear. Other gear types such as pound nets may be used in state water fisheries. All other MSB gear types permitted and allowed to fish in the fishery outside of trawls constitute a minor part of the total effort in the fishery and make up less than three to four percent of effort in the overall fishery (Dealer Database).

Several types of gillnet gear may be used in the MSB fishery, possibly by vessels catching mackerel to use as bait in other fisheries such as the tuna or lobster fishery. In recent years (last 10 years) these fisheries have declined somewhat and thus it is believed the bait component of this fishery has also greatly declined and is almost non existent. Vessels using bait gillnets to harvest MSB species are required to possess a permit and comply with mandatory reporting requirements. Thus, even a bait gillnet vessel that does not sell the mackerel but uses it to catch a species that it does sell, such as lobster or tuna, is required to obtain a MSB permit and comply with mandatory reporting.

The Mid-Atlantic Bottom Trawl Fishery has been defined as a Category II fishery in the 2007 List of Fisheries (72 FR 14466, March 28, 2007). There are at least 2 distinct components to this fishery. One is the mixed groundfish bottom trawl fishery and is managed via several FMPs outside of the present action. The second major component is the MSB fishery. This component is managed by the federal MSB FMP (50 CFR Part 648.20 through 648.24). The *Illex* and *Loligo* squid fisheries are managed by moratorium permits, gear and area restrictions, quotas, and trip limits. The Atlantic mackerel and Atlantic butterfish fisheries are managed by an annual quota system.

MSB bottom trawl total effort, measured in trips, for the domestic Atlantic mackerel fishery in the Mid-Atlantic Region (bottom trawl only) from 1997 to 2006 were 373, 278, 262, 102, 175, 310, 238, 231, 0, and 117 respectively (NMFS VTR Database). Total effort, measured in trips, for the *Illex* squid fishery from 1998 to 2006 were 412, 141, 108, 51, 39, 103, 445, 181, and 159 respectively (NMFS). Total effort, measured in trips, for the *Loligo* squid fishery from 1998 to 2006 were 1,048, 495, 529, 413, 3,585, 1,848, 1,124, 1,845, and 3,058 respectively (NMFS). In 2008, 371 vessels were issued *Loligo*/butterfish moratorium permits (combined limited access);

however, in general, fewer than 100 vessels have made landings in excess of 100,000 lb in the last decade. (From July 2009 MAFMC briefing doc). Atlantic butterfish is a bycatch (nondirected) fishery, therefore effort on this species is not reported.

Mid-water trawls (includes pair trawls) target Atlantic mackerel and other miscellaneous pelagic species. The Mid-Atlantic Mid-Water Trawl Fishery has been defined as a Category II fishery in the 2007 List of Fisheries (72 FR 14466, March 28, 2007). In 2006, approximately 400 federal mid-Atlantic permit holders identified midwater trawl as a potential gear type. Total effort, measured in trips, for the mid-Atlantic Mid-Water Trawl Fishery (across all gear types) from 1997 to 2006 was 331, 223, 374, 166, 408, 261, 428, 360, 359, and 405 respectively (NMFS). During the period 1997-2006, estimated observer coverage (% of trips) was 0.00%, 0.00%, 1.01%, 8.43%, 0.00%, 0.77%, 3.5%, 12.16%, 8.4% and 8.9% respectively. Thus, in more recent years observer coverage in the mid-water trawl fishery has been increased significantly (average 8.2%). This better or increased observer coverage trend in the MSB fisheries allows for a clearer and more precise understanding of the overall MSB fishery.

B. Action Area

The management unit for the Atlantic MSB FMP is defined in the FMP, and includes all waters of the United States Exclusive Economic Zone EEZ offshore of the northeastern and mid-Atlantic United States, which includes waters of the U.S. Atlantic coast (primarily northeast and Mid-Atlantic waters). For the purposes of this Opinion, the action area is defined as all US EEZ waters from Maine to the North Carolina/South Carolina border, and the territorial sea from Maine to the North Carolina/South Carolina border that is affected through the regulation of activities of Federal permit holders fishing in those areas.

3.0 Status of the species

NMFS has determined that the action being considered in the Opinion may affect the following ESA-listed sea turtle species in a manner that will likely result in adverse effects:

Common name	**Scientific name**	**ESA Status**
Loggerhead sea turtle	*Caretta caretta*	Threatened
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Green sea turtle	*Chelonia mydas*	Endangered[1]

[1] Green turtles in U.S. waters are listed as threatened except for the Florida breeding population which is listed as endangered. Due to the inability to distinguish between these populations away from the nesting beach, green turtles are considered endangered wherever they occur in U.S. waters.

NMFS has determined that the action being considered in the Opinion is no longer likely to adversely affect the shortnose sturgeon (*Acipenser brevirostrum*), nor is it likely to adversely affect the Gulf of Maine distinct population segment (DPS) of Atlantic salmon (*Salmo salar*), hawksbill sea turtles (*Eretmochelys imbricata*), North Atlantic right whales (*Eubalaena glacialis*), humpback whales (*Megaptera novaeangliae*), fin whales (*Balaenoptera physalus*), sei whales (*Balaenoptera borealis*), sperm whales (*Physeter macrocephalus*), and blue whales (*Balaenoptera musculus*), all of which are listed as endangered under the ESA. Thus, each of these species will not be considered further in this Opinion. The following discussion is NMFS's rationale for these determinations.

3.1 Analysis of Species Not Likely to be Adversely Affected

The 1999 Opinion on the MSB FMP evaluated the impacts of the FMP on ESA-listed cetaceans, including right whales. The 1999 Opinion concluded that the interactions between ESA-listed whales and the MSB fishery were not likely to occur. This conclusion was based on the fact that the vast majority (approximately 98%) of the MSB fishery is prosecuted using trawl gear — a gear type that is not known to interact with or pose a risk to large whales. MSB landings using gillnets (and other non trawl gears) are minor participants in the fishery. For these reasons, the gear associated with the secondary landings of MSB are not expected to likely affect ESA-listed species, and will not be considered further in this Opinion.

NMFS has also determined that the continued operation of the MSB fishery under the MSB FMP will not have any adverse effects on cetacean prey or their calving and nursing grounds. Right and sei whales feed on copepods (Horwood 2002; Kenney 2002). The MSB fishery will not affect the availability of copepods for foraging right and sei whales because copepods are very small organisms that will pass through MSB fishing gear rather than being captured in it. Dense aggregations of late stage and diapausing Calanus finmarchicus in the Gulf of Maine and Georges Bank region will not be affected by the MSB fishery. In addition, the physical and biological conditions and structures of the Gulf of Maine and Geroges Bank region and the oceanographic conditions in Jordan, Wilkinson and Georges Basin that aggregate and distribute Calanus finmarchicus are not affected by the MSB fishery. Blue whales feed on euphausiids (krill) (Sears 2002) which, likewise, are too small to be captured in MSB fishing gear. Humpback and fin whales also feed on krill as well as small schooling fish (*e.g.*, sand lance, herring, mackerel) (Aguilar 2002; Clapham 2002). Although small schooling fish species (including mackerel) may be caught in net gear targeting MSB, the numbers of individuals caught are likely insignificant. Therefore, the continued operation of the MSB fishery under the MSB FMP will not affect the availability of prey for foraging humpback or fin whales. Sperm whales feed on larger organisms that inhabit the deeper ocean regions (Whitehead 2002). The MSB fishery does not operate in these deep water areas. Therefore, the continued operation of the MSB fishery under the MSB FMP will not affect the availability of prey for foraging sperm whales. Calving and nursing grounds for all six species of cetaceans discussed here are located outside the geographic range of the MSB fishery, and thus will not be affected by the fishery.

As stated above, NMFS has further determined that the action being considered in this Opinion is not likely to adversely affect the shortnose sturgeon (*Acipenser brevirostrum*), the Gulf of Maine distinct population segment (DPS) of Atlantic salmon (*Salmo salar*), and hawksbill sea turtles (*Eretmochelys imbricata*), all of which are listed as endangered under the ESA. The following is NMFS's rationale for these determinations.

Shortnose sturgeon are benthic fish that occur in large coastal rivers of eastern North America. They range from as far south as the St. Johns River, Florida (possibly extirpated from this system) to as far north as 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 some northern populations are amphidromous (NMFS 1998a). Given the range of the species, shortnose sturgeon are not expected to be present in ocean areas where the MSB fishery operates. In addition, adverse effects are not expected since shortnose sturgeon interactions have never been documented within the MSB fishery.

The naturally spawned and conservation hatchery populations of anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, including those that were already listed in November 2000, are listed as endangered under the ESA (NMFS 2009a, 2009b). 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. Results from a 2001 post-smolt trawl survey in Penobscot Bay and the nearshore waters of the Gulf of Maine indicate that Atlantic salmon post-smolts are prevalent in the upper water column throughout this area in mid to late May. It is highly unlikely that the action being considered in this Opinion will affect the Gulf of Maine DPS of Atlantic salmon given that operation of the MSB fishery does not occur in or near the rivers where concentrations of Atlantic salmon are likely to be found. Thus, neither this species nor its designated critical habitat will be considered further in this Opinion.

The hawksbill sea turtle is uncommon in the waters of the continental U.S. Hawksbills prefer coral reef habitats, such as those found in the Caribbean and Central America. The waters surrounding Mona and Monito Islands (Puerto Rico) are designated as critical habitat for the species, and Buck Island (St. Croix, U.S. Virgin Islands) also contains especially important foraging and nesting habitat for hawksbills. Within the continental U.S., nesting is restricted to the southeast coast of Florida and the Florida Keys, but nesting is rare in these areas. Hawksbills have been recorded from all U.S. states adjacent to the Gulf of Mexico and along the east coast of the U.S. as far north as Massachusetts, although sightings north of Florida are rare. Aside from Florida, Texas is the only other U.S. state where hawksbills are sighted with any regularity. Since the MSB fishery does not operate in waters that are typically used by hawksbill sea turtles, it is highly unlikely that the fishery will adversely affect this sea turtle species. These species will not be considered further in this Opinion.

3.2 Analysis of Species Likely to be Adversely Affected

Sea turtles continue to be affected by many factors occurring on the nesting beaches and in the marine environment. Poaching, habitat modification and destruction, and nest predation affect eggs, hatchlings, and nesting females while on land. Fishery interactions, vessel interactions, marine pollution, and non-fishery operations (*e.g.*, dredging, military activities, oil and gas exploration), for example, affect sea turtles in the neritic zone, which is defined as the marine environment extending from mean low water down to 200 m (660 feet) in depth, generally corresponding to the continental shelf (Lalli and Parsons 1997; Encyclopedia Britannica 2009). Fishery interactions and marine pollution also affect sea turtles in the oceanic zone, which is defined as the open ocean environment where bottom depths are greater than 200 m (Lalli and Parsons 1997). As a result, sea turtles still face many of the original threats that were the cause of their listing under the ESA several decades ago.

Sea turtles are listed under the ESA at the species level rather than as subspecies or DPSs. Therefore, information on the range-wide status of each species is included in this Opinion. Additional background information on the range-wide status of these species, as well as a description and life history of the species, can be found in a number of published documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995; Hirth 1997; Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; NMFS and USFWS 2007a, 2007b, 2007c, 2007d; Conant *et al.* 2009; NMFS SEFSC 2009), and recovery plans for the loggerhead sea turtle (NMFS and USFWS 1998a, 2008), leatherback sea turtle (NMFS and USFWS 1992, 1998b), Kemp's ridley sea turtle (USFWS and NMFS 1992), and green sea turtle (NMFS and USFWS 1991, 1998c).

3.2.1 Loggerhead Sea Turtles

Loggerhead sea turtles are found in temperate and subtropical waters and occupy a range of habitats including offshore waters, continental shelves, bays, estuaries, and lagoons. The loggerhead is the most abundant species of sea turtle in U.S. waters. Genetic differences exist between loggerhead sea turtles that nest and forage in the different ocean basins (Bowen 2003; Bowen and Karl 2007). Differences in the maternally inherited mitochondrial DNA also exist between loggerhead nesting groups that occur within the same ocean basin (TEWG 2000; Pearce 2001; Bowen 2003; Bowen *et al.* 2005; Shamblin 2007). Site fidelity of females to one or more nesting beaches in an area is believed to account for these genetic differences (TEWG 2000; Bowen 2003). Loggerhead sea turtles are currently listed under the ESA at the species level rather than as subspecies or distinct population segments (DPS). The ESA requires NMFS to ultimately conclude whether the action under consultation, in light of the Environmental Baseline (Section 4.0) and Cumulative Effects (Section 5.0), is likely to jeopardize the species as it is listed. Therefore, information on the range-wide status of the species is included.

Pacific Ocean. In the Pacific Ocean, major loggerhead nesting grounds are generally located in temperate and subtropical regions with scattered nesting in the tropics. The abundance of loggerhead sea turtles at nesting colonies throughout the Pacific basin has declined dramatically over the past ten to twenty years. Loggerhead sea turtles in the Pacific Ocean are represented by a northwestern Pacific nesting group (located in Japan) and a smaller southwestern Pacific nesting group that occurs in Australia (Great Barrier Reef and Queensland), New Caledonia, New Zealand, Indonesia, and Papua New Guinea. Data from 1995 estimated the Japanese nesting group at 1,000 adult females (Bolten *et al.* 1996). More recent information suggests that nest numbers have increased somewhat over the period of 1998-2004 (NMFS and USFWS 2007a). However, this time period is too short to make a determination of the overall trend in nesting (NMFS and USFWS 2007a). Genetic analyses of loggerhead females nesting in Japan indicate the presence of genetically distinct nesting colonies (Hatase *et al.* 2002).

In Australia, long-term census data have been collected at some rookeries since the late 1960s and early 1970s, and nearly all the data show marked declines in nesting since the mid-1980s. The nesting group in Queensland, Australia was as low as 300 adult females in 1997 (Limpus and Limpus 2003).

Pacific loggerhead sea turtles are captured, injured, or killed in numerous Pacific fisheries including gillnet, longline, and trawl fisheries in the western and/or eastern Pacific Ocean (NMFS and USFWS 2007a). In Australia, where sea turtles are taken in bottom trawl and longline fisheries, efforts have been made to reduce fishery bycatch (NMFS and USFWS 2007a).

Indian Ocean. Loggerhead sea turtles are distributed throughout the Indian Ocean, along most mainland coasts and island groups (Baldwin *et al.* 2003). Throughout the Indian Ocean, loggerhead sea turtles face many of the same threats as in other parts of the world including loss of nesting beach habitat, fishery interactions, and turtle meat and/or egg harvesting.

In the southwestern Indian Ocean, loggerhead nesting has shown signs of recovery in South Africa where protection measures have been in place for decades. However, in other southwestern areas (*e.g.*, Madagascar and Mozambique) loggerhead nesting groups are still affected by subsistence hunting of adults and eggs (Baldwin *et al.* 2003). The largest known nesting group of loggerheads in the world occurs in Oman in the northern Indian Ocean. An estimated 20,000 to 40,000 female's nest at Masirah, the largest nesting site within Oman, each year (Baldwin *et al.* 2003). In the eastern Indian Ocean, all known nesting sites are found in Western Australia (Dodd 1988). As has been found in other areas, nesting numbers are disproportionate within the area with the majority of nesting occurring at a single location. This may, however, be the result of fox predation on eggs at other Western Australia nesting sites (Baldwin *et al.* 2003).

Mediterranean Sea. Nesting in the Mediterranean Sea is confined almost exclusively to the eastern basin (Margaritoulis *et al.* 2003). The greatest numbers of nests in the Mediterranean are found in Greece with an average of 3,050 nests per year (Margaritoulis *et al.* 2003; NMFS and USFWS 2007a). Turkey has the second largest number of nests with 2,000 nests per year (NMFS and USFWS 2007a). There is a long history of exploitation of loggerheads in the Mediterranean (Margaritoulis *et al.* 2003). Although much of this is now prohibited, some directed captures still occur (Margaritoulis *et al.* 2003). Loggerheads in the Mediterranean also face the threat of habitat degradation, incidental fishery interactions, vessel strikes, and marine pollution (Margaritoulis *et al.* 2003). Longline fisheries, in particular, are believed to catch thousands of juvenile loggerheads each year (NMFS and USFWS 2007a), although genetic analyses indicate that only a portion of the loggerheads captured originate from loggerhead nesting groups in the Mediterranean (Laurent *et al.* 1998).

Atlantic Ocean. Ehrhart *et al.* (2003) provided a summary of the literature identifying known nesting habitats and foraging areas for loggerheads within the Atlantic Ocean. Detailed information is also provided in the 5-year status review for loggerheads (NMFS and USFWS 2007a) and the final revised recovery plan for loggerheads in the Northwest Atlantic Ocean (NMFS and USFWS 2008), which is a second revision to the original recovery plan that was approved in 1984 and subsequently revised in 1991.

Briefly, nesting occurs on island and mainland beaches on both sides of the Atlantic and both north and south of the Equator (Ehrhart *et al.* 2003). By far, the majority of Atlantic nesting occurs on beaches of the southeastern U.S. (NMFS and USFWS 2007a). Annual nest counts for loggerhead sea turtles on beaches from other countries are in the hundreds with the exception of Brazil, where a total of 4,837 nests were reported for the 2003-2004 nesting season (Marcovaldi and Chaloupka 2007; NMFS and USFWS 2007a), and Mexico, where several thousand nests are estimated to be laid each year. For example, the Yucatán nesting population had a range of 903-2,331 nests per year from 1987-2001 (Zurita *et al.* 2003; NMFS and USFWS 2008). In both the eastern and western Atlantic, waters as far north as 41°N to 42°N latitude are used for foraging by juveniles as well as adults (Shoop 1987; Shoop and Kenney 1992; Ehrhart *et al.* 2003; Mitchell *et al.* 2003).

In U.S. Atlantic waters, loggerheads commonly occur throughout the inner continental shelf from Florida to Cape Cod, Massachusetts and in the Gulf of Mexico from Florida to Texas, although their presence varies with the seasons due to changes in water temperature (Shoop and Kenney 1992; Epperly *et al.* 1995a, 1995b; Braun and Epperly 1996; Epperly and Braun-McNeill 2002; Mitchell *et al.* 2003). Loggerheads have been observed in waters with surface temperatures of 7° to 30°C, but water temperatures ≥11°C are most favorable (Shoop and Kenney 1992; Epperly *et al.* 1995b). The presence of loggerhead sea turtles in U.S. Atlantic waters is also influenced by water depth. Aerial surveys of continental shelf waters north of Cape Hatteras, North Carolina indicated that loggerhead sea turtles were most commonly sighted in waters with bottom depths ranging from 22 to 49 m deep (Shoop and Kenney 1992). However, more recent survey and satellite tracking data support that they occur in waters from the beach to beyond the continental shelf (Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007).

Loggerhead sea turtles occur year round in ocean waters off North Carolina, South Carolina, Georgia, and Florida. In these areas of the South Atlantic Bight, water temperature is influenced by the proximity of the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the southeast U.S. (*e.g.*, Pamlico and Core Sounds) and also move up the U.S. Atlantic coast (Epperly *et al.* 1995a, 1995b, 1995c; Braun-McNeill and Epperly 2004), occurring in Virginia foraging areas as early as April/May and on the most northern foraging grounds in the Gulf of Maine in June (Shoop and Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by mid-September, but some turtles may remain in Mid-Atlantic and Northeast areas until late fall. By December, loggerheads have migrated from inshore and more northern coastal waters to waters offshore of North Carolina, particularly off of Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles (Shoop and Kenney 1992; Epperly *et al.* 1995b; Epperly and Braun-McNeill 2002).

In the southeastern U.S., loggerheads mate from late March to early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs (Dodd 1988). Individual females nest multiple times during a nesting season, with a mean of 4.1 nests per individual (Murphy and Hopkins 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2 to 3 years, but can vary from 1 to 7 years (Dodd 1988; NMFS and USFWS 2008). Age at sexual maturity for loggerheads has been estimated at 32 to 35 years (NMFS and USFWS 2008).

For the past decade or so, the scientific literature has recognized five distinct nesting groups, or subpopulations, of loggerhead sea turtles in the Northwest Atlantic, divided geographically as follows: (1) a northern group of nesting females that nest from North Carolina to northeast Florida at about 29°N latitude; (2) a south Florida group of nesting females that nest from 29°N latitude on the east coast to Sarasota on the west coast; (3) a Florida Panhandle group of nesting females that nest around Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán group of nesting females that nest on beaches of the eastern Yucatán Peninsula, Mexico (Márquez 1990; TEWG 2000); and (5) a Dry Tortugas group that nests on beaches of the islands of the Dry Tortugas, near Key West, Florida (NMFS SEFSC 2001). Genetic analyses of mitochondrial DNA, which a sea turtle inherits from its mother, indicate that there are genetic differences between loggerheads that nest at and originate from the beaches used by each of the five identified nesting groups of females (TEWG 2000). However, analyses of microsatellite loci from nuclear DNA, which represents the genetic contribution from both parents, indicates little to no genetic differences between loggerheads originating from nesting beaches of the five Northwest Atlantic nesting groups (Pearce and Bowen 2001; Bowen 2003; Bowen *et al.* 2005; Shamblin 2007). These results suggest that female loggerheads have site fidelity to nesting beaches within a particular area, while males provide an avenue of gene flow between nesting groups by mating with females that originate from different nesting groups (Bowen 2003; Bowen *et al.* 2005). The extent of such gene flow, however, is unclear (Shamblin 2007).

The lack of genetic structure makes it difficult to designate specific boundaries for the nesting subpopulations based on genetic differences alone. Therefore, the Loggerhead Recovery Team recently used a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to reassess the designation of these subpopulations to identify recovery units in the 2008 recovery plan.

In the 2008 recovery plan, the Loggerhead Recovery Team designated five recovery units for the Northwest Atlantic population of loggerhead sea turtles based on the aforementioned nesting groups and inclusive of a few other nesting areas not mentioned above. The first four of these recovery units represent nesting assemblages located in the southeast U.S. The fifth recovery unit is composed of all other nesting assemblages of loggerheads within the Greater Caribbean, outside the U.S., but which occur within U.S. waters during some portion of their lives. The five recovery units representing nesting assemblages are: (1) the Northern Recovery Unit (NRU: Florida/Georgia border through southern Virginia), (2) the Peninsular Florida Recovery Unit (PFRU: Florida/Georgia border through Pinellas County, Florida), (3) the Dry Tortugas

Recovery Unit (DTRU: islands located west of Key West, Florida), (4) the Northern Gulf of Mexico Recovery Unit (NGMRU: Franklin County, Florida through Texas), and (5) the Greater Caribbean Recovery Unit (GCRU: Mexico through French Guiana, Bahamas, Lesser Antilles, and Greater Antilles).

The Recovery Team evaluated the status and trends of the Northwest Atlantic loggerhead population for each of the five recovery units, using nesting data available as of October 2008 (NMFS and USFWS 2008). The level and consistency of nesting coverage varies among recovery units, with coverage in Florida generally being the most consistent and thorough over time. Since 1989, nest count surveys in Florida have occurred in the form of statewide surveys (a near complete census of entire Florida nesting) and index beach surveys (Witherington *et al.* 2009). Index beaches were established to standardize data collection methods and maintain a constant level of effort on key nesting beaches over time.

From the beginning of standardized index surveys in 1989 until 1998, the PFRU, the largest nesting assemblage in the Northwest Atlantic by an order of magnitude, had a significant increase in the number of nests. However, from 1998 through 2008, there was a 41% decrease in annual nest counts from index beaches, which represent an average of 70% of the statewide nesting activity (NMFS and USFWS 2008). From 1989-2008, the PFRU had an overall declining nesting trend of 26% (95% CI: -42% to -5%; NMFS and USFWS 2008). In 2008, an increase in nest counts from the previous four years was reported, but this did not alter the declining trend. The Loggerhead Recovery Team acknowledged that this dramatic change in status for the PFRU is a serious concern and requires immediate attention to determine the cause(s) of this change and the actions needed to reverse it. The NRU, the second largest nesting assemblage of loggerheads in the U.S., has been declining at a rate of 1.3% annually since 1983 (NMFS and USFWS 2008). The NRU dataset included 11 beaches with an uninterrupted time series of coverage of at least 20 years; these beaches represent approximately 27% of NRU nesting (in 2008). Overall, there is strong statistical data to suggest the NRU has experienced a long-term decline. Evaluation of long-term nesting trends for the NGMRU is difficult because of changed and expanded beach coverage. However, the NGMRU has shown a significant declining trend of 4.7% annually since index nesting beach surveys were initiated in 1997 (NMFS and USFWS 2008). No statistical trends in nesting abundance can be determined for the DTRU because of the lack of long-term data. Similarly, statistically valid analyses of long-term nesting trends for the entire GCRU are not available because there are few long-term standardized nesting surveys representative of the region. Additionally, changing survey effort at monitored beaches and scattered and low-level nesting by loggerheads at many locations currently precludes comprehensive analyses (NMFS and USFWS 2008).

Sea turtle census nesting surveys are important in that they provide information on the relative abundance of nesting each year, and the contribution of each nesting group to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The 2008 recovery plan compiled the most recent information on mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (i.e., nesting groups). They are: (1) for the NRU, a mean of 5,215 loggerhead nests per year (from 1989-2008) with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year (from 1989-2007) with approximately

15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year (from 1995-2004, excluding 2002) with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year (from 1995-2007) with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit. Note that the above values for average nesting females per year were based upon 4.1 nests per female per Murphy and Hopkins (1984).

Unlike nesting surveys, in-water studies of sea turtles typically sample both sexes and multiple age classes. In-water studies have been conducted in some areas of the Northwest Atlantic and provide data by which to assess the relative abundance of loggerhead sea turtles and changes in abundance over time (Maier *et al.* 2004; Morreale *et al.* 2005; Mansfield 2006; Ehrhart *et al.* 2007; Epperly *et al.* 2007). The 2008 loggerhead recovery plan includes a full discussion of in-water population studies for which trend data have been reported, and a brief summary will be provided here. Maier *et al.* (2004) used fishery-independent trawl data to establish a regional index of loggerhead abundance for the southeast coast of the U.S. (Winyah Bay, South Carolina to St. Augustine, Florida) during the period 2000-2003. A comparison of loggerhead catch data from this study with historical values suggested that in-water populations of loggerhead sea turtles along the southeast U.S. coast appear to be larger, possibly an order of magnitude higher than they were 25 years ago, but the authors caution a direct comparison between the two studies given differences in sampling methodology (Maier *et al.* 2004). A comparison of catch rates for sea turtles in pound net gear fished in the Pamlico-Albemarle Estuarine Complex of North Carolina between the years 1995-1997 and 2001-2003 found a significant increase in catch rates for loggerhead sea turtles for the latter period (Epperly *et al.* 2007). A long-term, on-going study of loggerhead abundance in the Indian River Lagoon System of Florida found a significant increase in the relative abundance of loggerheads over the last 4 years of the study (Ehrhart *et al.* 2007). However, there was no discernible trend in loggerhead abundance during the 24-year time period of the study (1982-2006) (Ehrhart *et al.* 2007). At St. Lucie Power Plant, data collected from 1977-2004 show an increasing trend of loggerheads at the power plant intake structures (FPL and Quantum Resources 2005).

In contrast to these studies, Morreale *et al.* (2005) observed a decline in the percentage and relative numbers of loggerhead sea turtles incidentally captured in pound net gear fished around Long Island, New York during the period 2002-2004 in comparison to the period 1987-1992, with only two loggerheads (of a total 54 turtles) observed captured in pound net gear during the period 2002-2004. This is in contrast to the previous decade's study where numbers of individual loggerheads ranged from 11 to 28 per year (Morreale *et al.* 2005). No additional loggerheads were reported captured in pound net gear through 2007, although 2 were found cold-stunned on Long Island bay beaches in the fall of 2007 (Memo to the File, L. Lankshear, December 2007). Potential explanations for this decline include major shifts in loggerhead foraging areas and/or increased mortality in pelagic or early benthic stage/age classes (Morreale *et al.* 2005). Using aerial surveys, Mansfield (2006) also found a decline in the densities of loggerhead sea turtles in Chesapeake Bay over the period 2001-2004 compared to aerial survey data collected in the 1980s. Significantly fewer loggerheads ($p<0.05$) were observed in both the spring (May-June) and the summer (July-August) of 2001-2004 compared to those observed during aerial surveys in the 1980s (Mansfield 2006). A comparison of median densities from the 1980s to the 2000s suggested that there had been a 63.2% reduction in densities during the spring residency period and a 74.9% reduction in densities during the summer residency period (Mansfield 2006). The decline in observed loggerhead populations in Chesapeake Bay may be related to a significant decline in prey, namely horseshoe crabs and blue crabs, with loggerheads redistributing outside of Bay waters (NMFS and USFWS 2008).

The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the neritic environment, and in the oceanic environment. Recent studies have established that the loggerhead's life history is more complex than previously believed. Rather than making discrete developmental shifts from oceanic to neritic environments, research is showing that both adults and (presumed) neritic stage juveniles continue to use the oceanic environment and will move back and forth between the two habitats (Witzell 2002; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007). One of the studies tracked the movements of adult post-nesting females and found that differences in habitat use were related to body size with larger adults staying in coastal waters and smaller adults traveling to oceanic waters (Hawkes *et al.* 2006). A tracking study of large juveniles found that the habitat preferences of this life stage were also diverse with some remaining in neritic waters and others moving off into oceanic waters (McClellan and Read 2007). However, unlike the Hawkes *et al.* (2006) study, there was no significant difference in the body size of turtles that remained in neritic waters versus oceanic waters (McClellan and Read 2007). In either case, the research demonstrates that threats to loggerheads in both the neritic and oceanic environments are likely impacting multiple life stages of this species.

The 5-year status review and 2008 recovery plan provide a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and USFWS 2007a, 2008). Amongst those of natural origin, hurricanes are known to be destructive to sea turtle nests. Sand accretion, rainfall, and wave action that result from these storms can appreciably reduce hatchling success. Other sources of natural mortality include cold stunning, biotoxin exposure, and native species predation.

Anthropogenic factors that impact hatchlings and adult females on land, or the success of nesting and hatching include: beach erosion, beach armoring, and nourishment; artificial lighting; beach cleaning; beach pollution; increased human presence; recreational beach equipment; vehicular and pedestrian traffic; coastal development/construction; exotic dune and beach vegetation; removal of native vegetation; and poaching. An increased human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs, and an increased presence of native species (*e.g.*, raccoons, armadillos, and opossums) which raid nests and feed on turtle eggs (NMFS and USFWS 2007a, 2008). Although sea turtle nesting beaches are protected along large expanses of the Northwest Atlantic coast (in areas like Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected high density east Florida nesting beaches from Indian River to Broward County are affected by all of the above threats.

Loggerheads are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development, and transportation; marine pollution; underwater explosions; hopper dredging; offshore artificial lighting; power plant entrainment and/or impingement; entanglement in debris; ingestion of marine debris; marina and dock construction and operation; boat collisions; poaching; and fishery interactions.

A 1990 National Research Council (NRC) report concluded that for juveniles, subadults, and breeders in coastal waters, the most important source of human caused mortality in U.S. Atlantic waters was fishery interactions. Of the many fisheries known to adversely affect loggerheads, the U.S. south Atlantic and Gulf of Mexico shrimp fisheries were considered to pose the greatest threat of mortality to neritic juvenile and adult age classes of loggerheads, accounting for an estimated 5,000 to 50,000 loggerhead deaths each year (NRC 1990). Significant changes to the south Atlantic and Gulf of Mexico shrimp fisheries have occurred since 1990, and the effects of these shrimp fisheries on ESA-listed species, including loggerhead sea turtles, have been assessed several times through section 7 consultation. There is also a lengthy regulatory history with regard to the use of Turtle Excluder Devices (TEDs) in the U.S. south Atlantic and Gulf of Mexico shrimp fisheries (Epperly and Teas 2002; NMFS 2002a; Lewison *et al.* 2003). Section 7 consultation on shrimp trawling in the southeastern U.S. was reinitiated in 2002, in part, to consider the effect of a new rulemaking that would require increasing the size of TED escape openings to allow larger loggerheads (as well as green and leatherback sea turtles) to escape from shrimp trawl gear. The resulting Opinion was completed in December 2002 and concluded that, as a result of the new rule, annual loggerhead mortality from capture in shrimp trawls would decline from an estimated 62,294 to 3,948 turtles assuming that all TEDs were installed properly and that compliance was 100% (Epperly *et al.* 2002; NMFS 2002a). The total annual level of take for loggerhead sea turtles as a result of the U.S. south Atlantic and Gulf of Mexico shrimp fisheries was estimated to be 163,160 loggerhead interactions (the total number of turtles that enter a shrimp trawl, which may then escape through the TED or fail to escape and be captured) with 3,948 of those takes being lethal (NMFS 2002a). On February 21, 2003, NMFS issued the final rule in the *Federal Register* to require the use of the larger opening TEDs (68 FR 8456). The rule also provided the measures to disallow several previously approved TED designs that did not function properly under normal fishing conditions, and to require modifications to the trynet and bait shrimp exemptions to the TED requirements to decrease mortality of sea turtles.

In addition to improvements in TED designs and TED enforcement, interactions between loggerheads and the shrimp fishery have also been declining because of reductions in fishing effort unrelated to fisheries management actions. The 2002 Opinion take estimates are based in part on fishery effort levels. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of recent hurricanes in the Gulf of Mexico have all impacted the shrimp fleets; in some cases reducing fishing effort by as much as 50% for offshore waters of the Gulf of Mexico (GMFMC 2007). As a result, loggerhead interactions and mortalities in the Gulf of Mexico have been substantially less than projected in the 2002 Opinion. Currently, the estimated annual number of interactions between loggerheads and shrimp trawls in the Gulf of Mexico shrimp fishery is 23,336, with 647 (2.8%) of those interactions resulting in mortality (Memo from Dr. B. Ponwith, Southeast Fisheries Science Center [SEFSC] to Dr. R. Crabtree, Southeast Region [SERO], PRD, December 2008).

Loggerhead sea turtles are also known to interact with non-shrimp trawl, gillnet, longline, dredge, pound net, pot/trap, and hook and line fisheries. The NRC (1990) report stated that other U.S. Atlantic fisheries collectively accounted for 500 to 5,000 loggerhead deaths each year, but recognized that there was considerable uncertainty in the estimate. The first estimate of loggerhead sea turtle bycatch in U.S. Mid-Atlantic bottom otter trawl gear was completed in September 2006 and later updated in November 2008 (Murray 2006, 2008). Observers reported 66 loggerhead sea turtle interactions with bottom otter trawl gear from 1994-2004 of which 38 were reported as alive and uninjured and 28 were reported as dead, injured, resuscitated, or of unknown condition (Murray 2006, 2008). Seventy-seven percent of observed sea turtle interactions occurred on vessels fishing for summer flounder (50%) and Atlantic croaker (27%). The remaining 23% of observed interactions occurred on vessels targeting weakfish (11%), long-finned squid (8%), groundfish (3%), and short-finned squid (1%). Based on observed interactions and fishing effort as reported on VTRs, the average annual loggerhead bycatch in these bottom otter trawl fisheries combined was estimated to be 616 sea turtles per year for the period 1996-2004 (Murray 2006, 2008).

The 2008 update also reported loggerhead bycatch from 2000-2004 by main species (fish or invertebrate) group caught, which is a proxy for FMP group (which is not well reported in the observer data). The average annual bycatch estimate of loggerhead sea turtles from 2000-2004 (based on the rate from 1994-2004) over FMP groups identified by NERO was 411 turtles, with an additional 77 estimated bycatch events unassigned. An estimated 192 (47%) of assigned takes occurred annually in the summer flounder/scup/black sea bass group, 62 (15%) in the Atlantic mackerel/squid/butterfish group, 43 (10%) in the Northeast multispecies group, and 41 (10%) in the Atlantic croaker group. A total of 20 loggerheads (4.8%) were estimated as having been taken annually in bottom otter trawl gear catching sea scallops, which is in addition to the estimated 81-191 loggerheads reported by Murray (2007) as being caught annually in trawl gear designed specifically to harvest scallops based on data from 2004-2005 (Murray 2008).

There have been several published estimates of the number of loggerheads taken annually as a result of the dredge fishery for Atlantic sea scallops, ranging from a low of zero in 2005 (Murray 2007) to a high of 749 in 2003 (Murray 2004). An estimate of the number of loggerheads taken annually in U.S. Mid-Atlantic gillnet fisheries has recently been published in Murray (2009). From 1995-2006, the average annual bycatch of loggerheads in U.S. Mid-Atlantic gillnet gear was estimated to be around 350 turtles (95% CI: 234 to 504). Bycatch rates were correlated with latitude, sea surface temperature, and mesh size. The highest predicted bycatch rates occurred in warm waters of the southern Mid-Atlantic in large-mesh gillnets (Murray 2009).

The U.S. tuna and swordfish longline fisheries that are managed under the Highly Migratory Species (HMS) FMP are estimated to capture 1,905 loggerheads (no more than 339 mortalities) for each 3-year period starting in 2007 (NMFS 2004). NMFS has mandated gear changes for the HMS fishery to reduce sea turtle bycatch and the likelihood of death from those incidental takes that would still occur (Garrison *et al.* 2009). In 2008, there were 82 observed interactions between loggerhead sea turtles and longline gear used in the HMS fishery. All of the loggerheads were released alive, but the vast majority with injuries (Garrison *et al.* 2009). Most of the injured loggerheads had been hooked in the mouth or beak or swallowed the hook

(Garrison *et al.* 2009). Based on the observed take, an estimated 771.6 (95% CI: 481.4-1236.6) loggerhead sea turtles are estimated to have been taken in the longline fisheries managed under the HMS FMP in 2008 (Garrison *et al.* 2009). The 2008 estimate is higher than that in 2007 and is consistent with historical averages since 2001 (Garrison *et al.* 2009). This fishery represents just one of several longline fisheries operating in the Atlantic Ocean. Lewison *et al.* (2004) estimated that 150,000-200,000 loggerheads were taken in all Atlantic longline fisheries in 2000 (including the U.S. Atlantic tuna and swordfish longline fisheries as well as others).

Summary of Status for Loggerhead Sea Turtles
Loggerheads are a long-lived species and reach sexual maturity relatively late at around 32-35 years in the Northwest Atlantic (NMFS and USFWS 2008). The species continues to be affected by many factors occurring on nesting beaches and in the water. These include poaching, habitat loss, and nesting predation that affects eggs, hatchlings, and nesting females on land, as well as fishery interactions, vessel interactions, marine pollution, and non-fishery (e.g., dredging) operations affecting all sexes and age classes in the water (NRC 1990; NMFS and USFWS 2007a). As a result, loggerheads still face many of the original threats that were the cause of their listing under the ESA.

As mentioned previously, a final revised recovery plan for loggerhead sea turtles in the Northwest Atlantic was recently published by NMFS and FWS in December 2008. The revised recovery plan is significant in that it identifies five unique recovery units, which comprise the population of loggerheads in the Northwest Atlantic, and describes specific recovery criteria for each recovery unit. Based on the most recent information, a decline in annual nest counts has been measured or suggested for three of the five recovery units for loggerheads in the Northwest Atlantic. This includes the PFRU, which is the largest (in terms of number of nests laid) in the Atlantic Ocean. The nesting trends for the other two recovery units could not be determined due to an absence of long term data.

NMFS convened a new Loggerhead Turtle Expert Working Group (TEWG) to review all available information on Atlantic loggerheads in order to evaluate the status of this species in the Atlantic. A final report from the Loggerhead TEWG was recently published in July 2009. In this report, the TEWG indicated that it could not determine whether or not the decreasing annual numbers of nests among the Northwest Atlantic loggerhead subpopulations were due to stochastic processes resulting in fewer nests, a decreasing average reproductive output of adult females, decreasing numbers of adult females, or a combination of these factors. Many factors are responsible for past or present loggerhead mortality that could impact current nest numbers; however, no single mortality factor stands out as a likely primary factor. It is likely that several factors compound to create the current decline, including incidental capture (in fisheries, power plant intakes, and dredging operations), lower adult female survival rates, increases in the proportion of first-time nesters, continued directed harvest, and increases in mortality due to disease. Regardless, the TEWG stated that the current levels of hatchling output will no doubt result in depressed recruitment to subsequent life stages over the coming decades (TEWG 2009).

Currently, there are no population estimates for loggerhead sea turtles in any of the ocean basins in which they occur. However, a recent loggerhead assessment prepared by NMFS states that the loggerhead adult female population in the western North Atlantic ranges from 20,000 to 40,000 or more, with a large range of uncertainty in total population size (NMFS SEFSC 2009).

Based on their 5-year status review of the species, NMFS and USFWS (2007a) determined that loggerhead sea turtles should not be delisted or reclassified as endangered. However, it was also determined that an analysis and review of the species should be conducted in the future to determine whether DPSs should be identified for the loggerhead (NMFS and USFWS 2007a). In 2008, NMFS and FWS established a Loggerhead Biological Review Team (BRT) to assess the global loggerhead population structure to determine whether DPSs exist and, if so, the status of each DPS. The BRT report was recently completed in August 2009 (Conant *et al.* 2009). In this report, the BRT identified the following nine loggerhead DPSs distributed globally: (1) North Pacific Ocean, (2) South Pacific Ocean, (3) North Indian Ocean, (4) Southeast Indo-Pacific Ocean, (5) Southwest Indian Ocean, (6) Northwest Atlantic Ocean, (7) Northeast Atlantic Ocean, (8) Mediterranean Sea, and (9) South Atlantic Ocean. According to an analysis using expert opinion in a matrix model framework used in the BRT report, all loggerhead DPSs have the potential to decline in the future. Although some DPSs are indicating increasing trends at nesting beaches (Southwest Indian Ocean and South Atlantic Ocean), available information about anthropogenic threats to juveniles and adults in neritic and oceanic environments indicate possible unsustainable additional mortalities. According to the threat matrix analysis in the BRT report, the potential for future decline is greatest for the North Indian Ocean, Northwest Atlantic Ocean, Northeast Atlantic Ocean, Mediterranean Sea, and South Atlantic Ocean DPSs (Conant *et al.* 2009.

On March 16, 2010, NMFS and USFWS published a proposed rule in the Federal Register to divide the worldwide population of loggerhead sea turtles into nine DPSs, as described in the 2009 Status Review. Two of the DPSs are proposed to be listed as threatened and seven of the DPSs, including the Northwest Atlantic Ocean DPS, are proposed to be listed as endangered (75 FR 12597, March 16, 2010). NMFS and the USFWS are accepting comments on the proposed rule through September 13, 2010 (75 FR 30769, June 2, 2010).

3.2.2 Leatherback Sea Turtle

Leatherback sea turtles are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic and Pacific Oceans, the Caribbean Sea, and the Gulf of Mexico (Ernst and Barbour 1972). Leatherback sea turtles are the largest living turtles and range farther than any other sea turtle species. Their large size and tolerance of relatively low temperatures allows them to occur in northern boreal waters such as those off Labrador and in the Barents Sea (NMFS and USFWS 1995).

In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982). By 1995, this global population of adult females was estimated to have declined to 34,500 (Spotila *et al.* 1996). However, the most recent population size estimate for the North Atlantic alone is a range of 34,000-94,000 adult leatherbacks (Leatherback TEWG 2007). Thus, there is substantial uncertainty with respect to global population estimates of leatherback sea turtles.

Pacific Ocean. Leatherback nesting has been declining at all major Pacific basin nesting beaches for the last two decades (Spotila *et al.* 1996, 2000; NMFS and USFWS 1998a; Sarti *et al.* 2000). Leatherback sea turtles disappeared from India before 1930, have been virtually extinct in Sri Lanka since 1994, and appear to be approaching extinction in Malaysia (Spotila *et al.* 2000). For example, the nesting group on Terengganu (Malaysia) - which was one of the most significant nesting sites in the western Pacific Ocean - has declined severely from an estimated 3,103 females in 1968 to 2 nesting females in 1994 (Chan and Liew 1996). Nesting groups of leatherback sea turtles along the coasts of the Solomon Islands, which historically supported important nesting groups, are also reported to be declining (D. Broderick, pers. comm., *in* Dutton *et al.* 1999). In Fiji, Thailand, Australia, and Papua-New Guinea (East Papua), leatherback sea turtles have only been known to nest in low densities and scattered colonies.

Only an Indonesian nesting group has remained relatively abundant in the Pacific basin. The largest, extant leatherback nesting group in the Indo-Pacific lies on the north Vogelkop coast of Irian Jaya (West Papua), Indonesia, with over 1,000 nesting females during the 1996 season (Suárez *et al.* 2000). During the early-to-mid 1980s, the number of female leatherback sea turtles nesting on the two primary beaches of Irian Jaya appeared to be stable. However, in 1999, local Indonesian villagers started reporting dramatic declines in sea turtles near their villages (Suárez 1999). Declines in nesting groups have been reported throughout the western Pacific region where observers report that nesting groups are well below abundance levels that were observed several decades ago (*e.g.*, Suárez 1999).

In the western Pacific Ocean and South China Sea, leatherback sea turtles are captured, injured, or killed in numerous fisheries including Japanese longline fisheries. Leatherback sea turtles in the western Pacific are also threatened by poaching of eggs, killing of nesting females, human encroachment on nesting beaches, incidental capture in fishing gear, beach erosion, and egg predation by animals.

In the eastern Pacific Ocean, leatherback nesting is declining along the Pacific coast of Mexico and Costa Rica. According to reports from the late 1970s and early 1980s, three beaches located on the Pacific coast of Mexico support as many as half of all leatherback sea turtle nests. Since the early 1980s, the eastern Mexican Pacific population of adult female leatherback turtles has declined to slightly more than 200 during 1998-1999 and 1999-2000 (Sarti *et al.* 2000). Spotila *et al.* (2000) reported the decline of the leatherback nesting at Playa Grande, Costa Rica, which had been the fourth largest nesting group in the world. Between 1988 and 1999, the nesting group declined from 1,367 to 117 female leatherback sea turtles. Based on their models, Spotila *et al.* (2000) reported the decline of the leatherback nesting at Playa Grande, Costa Rica, which had been the fourth largest nesting group in the world and the most important nesting beach in the Pacific, this decline is exemplified in nesting during the past 15 years of monitoring (1989-2004) with approximately 1,504 females nesting in 1988-1989 to an average of 188 females nesting in 2000-2001 and 2003-2004 (NMFS and USFWS 2007b). A similar dramatic decline has been seen on nesting beaches in Mexican Pacific coast, where tens of thousands of leatherback nests were laid on the beaches in the 1980s but where a total of only 120 nests on the four primary index beaches (combined) were counted in the 2003-2004 season (Sarti Martinez *et al.* 2007).

Commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet fisheries are known to capture, injure, or kill leatherbacks in the eastern Pacific Ocean. Given the declines in leatherback nesting in the Pacific, some researchers have concluded that the leatherback is on the verge of extinction in the Pacific Ocean (*e.g.*, Spotila *et al.* 1996, 2000).

Indian Ocean. Leatherbacks nest in several areas around the Indian Ocean. These sites include Tongaland, South Africa (Pritchard 2002) and the Andaman and Nicobar Islands (Andrews *et al.* 2002). Intensive survey and tagging work in 2001 provided new information on the level of nesting in the Andaman and Nicobar Islands (Andrews *et al.* 2002). Based on the survey and tagging work, it was estimated that 400-500 female leatherbacks nest annually on Great Nicobar Island (Andrews *et al.* 2002). The number of nesting females using the Andaman and Nicobar Islands combined was estimated around 1000 (Andrews and Shanker 2002). Some nesting also occurs along the coast of Sri Lanka although in much smaller numbers than in the past (Pritchard 2002).

Atlantic Ocean. Evidence from tag returns and stranding in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between boreal, temperate, and tropical waters (NMFS and USFWS 1992). Leatherbacks are frequently thought of as a pelagic species that feed on jellyfish (*i.e.*, *Stomolophus, Chryaora*, and *Aurelia*) and tunicates (salps, pyrosomas) in oceanic habitats (Rebel 1974; Davenport and Balazs 1991). However, leatherbacks are also known to use coastal waters of the U.S. continental shelf (James *et al.* 2005a; Eckert *et al.* 2006; Murphy *et al.* 2006) as well as the European continental shelf on a seasonal basis (Witt *et al.* 2007).

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. Leatherbacks were sighted in water depths ranging from 1-4,151 m but 84.4% of sightings were in waters less than 180 m (Shoop and Kenney 1992). Leatherbacks were sighted in waters within a sea surface temperature range similar to that observed for loggerheads; from 7°-27.2°C (Shoop and Kenney 1992). However, leatherbacks appear to have a greater tolerance for colder waters in comparison to loggerhead sea turtles since more leatherbacks were found at the lower temperatures as compared to loggerheads (Shoop and Kenney 1992). 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). However, the estimate was based on turtles visible at the surface and does not include those that were below the surface out of view. Therefore, it likely underestimates the leatherback population for the northeastern U.S. Estimates of leatherback abundance of 1,052 turtles (C.V. = 0.38) and 1,174 turtles (C.V. = 0.52) were obtained from surveys conducted from Virginia to the Gulf of St. Lawrence in 1995 and 1998, respectively (Palka 2000). However, since these estimates were also based on sightings of leatherbacks at the surface, the author considered the estimates to be negatively biased and the true abundance of leatherbacks may be 4.27 times the estimates (Palka 2000). Studies of satellite tagged leatherbacks suggest that they spend a 10%-41% of their time at the surface, depending on the phase of their migratory cycle (James *et al.* 2005b). The greatest amount of surface time (up to 41%) was recorded when leatherbacks occurred in continental shelf and slope waters north of 38°N (James *et al.* 2005b).

Leatherbacks are a long lived species (>30 years). They mature at a younger age than loggerhead sea turtles, with an estimated age at sexual maturity of about 13-14 years for females with 9 years reported as a likely minimum (Zug and Parham 1996) and 19 years as a likely maximum (NMFS SEFSC 2001). In the U.S. and Caribbean, female leatherbacks nest from March through July. They nest frequently (up to 7 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and can produce 700 eggs or more per nesting season (Schultz 1975). However, a significant portion (up to approximately 30%) of the eggs can be infertile. Therefore, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. As is the case with other sea turtle species, leatherback hatchlings enter the water soon after hatching. Based on a review of all sightings of leatherback sea turtles of <145 centimeters (cm) (56.55 inches) curved carapace length (CCL), Eckert (1999) found that leatherback juveniles remain in waters warmer than 26° C until they exceed 100 cm (39 in) CCL.

As described in Section 3.1.1, sea turtle nesting survey data is important in that it provides information on the relative abundance of nesting, and the contribution of each population/subpopulation to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually, and as an indicator of the trend in the number of nesting females in the nesting group. The 5-year review for leatherback sea turtles (NMFS and USFWS 2007b) compiled the most recent information on mean number of leatherback nests per year for each of the seven leatherback populations or groups of populations that were identified by the Leatherback TEWG as occurring within the Atlantic. These are: Florida, North Caribbean, Western Caribbean, Southern Caribbean, West Africa, South Africa, and Brazil. In the U.S., the Florida Statewide Nesting Beach Survey program has documented an increase in leatherback nesting numbers from 98 nests in 1988 to between 800 and 900 nests in the early 2000s (NMFS and USFWS 2007b). An analysis of Florida's INBS sites from 1989-2006 shows a substantial increase in leatherback nesting in Florida during this time, with an annual growth rate of approximately 1.17 (Leatherback TEWG 2007). The TEWG reports an increasing or stable trend for five of the seven populations or groups of populations with the exception of the Western Caribbean and West Africa. However, caution is also warranted even for those that were identified as stable or increasing. In St. Croix, for example, researchers have noted a declining presence of neophytes (first-time nesters) since 2002 (Garner and Garner 2007).

In addition, the leatherback rookery along the northern coast of South America in French Guiana and Suriname supports the majority of leatherback nesting in the western Atlantic (Leatherback TEWG 2007), and represents more than half of total nesting by leatherback sea turtles worldwide (Hilterman and Goverse 2004). Nest numbers in Suriname have shown an increase and the long-term trend for the Suriname and French Guiana nesting group seems to show an increase (Hilterman and Goverse 2004). In 2001, the number of nests for Suriname and French Guiana combined was 60,000, one of the highest numbers observed for this region in 35 years (Hilterman and Goverse 2004). The Leatherback TEWG (2007) report indicates that using nest numbers from 1967-2005, a positive population growth rate was found over the 39-year period for French Guinea and Suriname, with a 95% probability that the population was growing. Nevertheless, given the magnitude of leatherback nesting in this area compared to other nest sites, impacts to this area that negatively impact leatherback sea turtles could have profound impacts on the species overall.

Tag return data demonstrate that leatherbacks that nest in South America also utilize U.S. waters. A nesting female tagged on May 29, 1990 in French Guiana was later recovered and released alive from the York River, Virginia. Another nester tagged in French Guiana was later found dead in Palm Beach, Florida (Sea Turtle Stranding and Salvage Network (STSSN) database). Many other examples also exist. For example, leatherbacks tagged at nesting beaches in Costa Rica have been found in Texas, Florida, South Carolina, Delaware, and New York (STSSN database). Leatherback sea turtles tagged in Puerto Rico, Trinidad, and the Virgin Islands have also been subsequently found on U.S. beaches of southern, Mid-Atlantic, and northern states (STSSN database).

Of the Atlantic sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), and their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, and perhaps to the lightsticks used to attract target species in longline fisheries. They are also susceptible to entanglement in gillnets (used in various fisheries) and capture in trawl gear (*e.g.*, shrimp trawls, bottom otter trawls). Sea turtles entangled in fishing gear generally have a reduced ability to feed, dive, and surface to breathe, or perform any other behavior essential to survival (Balazs 1985). In addition to drowning from forced submergence, they may be more susceptible to boat strikes if forced to remain at the surface, and entangling lines can constrict blood flow resulting in tissue necrosis.

Leatherbacks are exposed to pelagic longline fisheries in many areas of their range. According to observer records, an estimated 6,363 leatherback sea turtles were caught by the U.S. Atlantic tuna and swordfish longline fisheries between 1992-1999, of which 88 were released dead (NMFS SEFSC 2001). Since the U.S. fleet accounts for only 5%-8% of the longline hooks fished in the Atlantic Ocean, adding up the under-represented observed takes of the other 23 countries actively fishing in the area would likely result in annual take estimates of thousands of leatherbacks over different life stages (NMFS SEFSC 2001).

Leatherbacks are susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer *et al.* 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer *et al.* 2002). A review of leatherback mortality documented by the STSSN in Massachusetts suggests that vessel strikes and entanglement in fixed gear (primarily lobster pots and whelk pots) are the principal sources of this mortality (Dwyer *et al.* 2002). Fixed gear fisheries in the Mid-Atlantic have also contributed to leatherback entanglements. For example, in North Carolina, two leatherback sea turtles were reported entangled in a crab pot buoy inside Hatteras Inlet (NMFS SEFSC 2001). A third leatherback was reported entangled in a crab pot buoy in Pamlico Sound off of Ocracoke. This turtle was disentangled and released alive; however, lacerations on the front flippers from the lines were evident (NMFS SEFSC 2001). In the southeast U.S., leatherbacks are vulnerable to entanglement in Florida's lobster pot and stone crab fisheries as documented on stranding forms. In the U.S. Virgin Islands, where one of five leatherback strandings from 1982 to 1997 were due to entanglement (Boulon 2000), leatherbacks have been observed with their flippers wrapped in the line of West Indian fish traps (R. Boulon, pers. comm. to Joanne Braun-McNeill, NMFS SEFSC 2001).

Leatherback interactions with the U.S. south Atlantic and Gulf of Mexico shrimp fisheries are also known to occur (NMFS 2002b). Leatherbacks are likely to encounter shrimp trawls working in the coastal waters off the U.S. Atlantic coast (from Cape Canaveral, Florida through North Carolina) as they make their annual spring migration north. For many years, TEDs that were required for use in the U.S. south Atlantic and Gulf of Mexico shrimp fisheries were less effective for leatherbacks as compared to the smaller, hard-shelled turtle species, because the TED openings were too small to allow leatherbacks to escape. To address this problem, NMFS issued a final rule on February 21, 2003 to amend the TED regulations. Modifications to the design of TEDs are now required in order to exclude leatherbacks as well as large benthic immature and sexually mature loggerhead and green sea turtles (see section 3.1.1 above for further information on the shrimp trawl fishery).

Other trawl fisheries are also known to interact with leatherback sea turtles although on a much smaller scale. In October 2001, for example, a fisheries observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off of Delaware. TEDs are not required in this fishery. In November 2007, fisheries observers reported the capture of a leatherback sea turtle in bottom otter trawl gear fishing for summer flounder (NEFSC Observer Program).

Gillnet fisheries operating in the nearshore waters of the Mid-Atlantic states are also known to capture, injure, and/or kill leatherbacks when these fisheries and leatherbacks co-occur. Data collected by the NEFSC Fisheries Observer Program from 1994-1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period (NEFSC Observer Program). Observer coverage for this period ranged from 54%-92%. In North Carolina, a leatherback was reported captured in a gillnet set in Pamlico Sound in the spring of 1990 (D. Fletcher, pers. comm. to S. Epperly, NMFS SEFSC 2001). Five other leatherbacks were released alive from nets set in North Carolina during the spring months: one was from a net (unknown gear) set in the nearshore waters near the North Carolina/Virginia border (1985); two others had been caught in gillnets set off of Beaufort Inlet (1990); a fourth was caught in a gillnet set off of Hatteras Island (1993), and a fifth was caught in a sink net set in New River Inlet (1993). In addition to these, in September 1995, two dead leatherbacks were removed from an 11-inch (28.2-cm) monofilament shark gillnet set in the nearshore waters off of Cape Hatteras (STSSN unpublished data reported in NMFS SEFSC 2001).

Fishing gear interactions and poaching are problems for leatherbacks throughout their range. Entanglements are 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. Leatherbacks are known to drown in fish nets set in coastal waters of Sao Tome, West Africa (Castroviejo *et al.*

1994; Graff 1995). Gillnets are one of the suspected causes for the decline in the leatherback sea turtle population in French Guiana (Chevalier *et al.* 1999), and gillnets targeting green and hawksbill sea turtles in the waters of coastal Nicaragua also incidentally catch leatherback sea turtles (Lagueux 1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio-M. 2000). An estimated 1,000 mature female leatherback sea turtles are caught annually in fishing nets off of Trinidad and Tobago with mortality estimated to be between 50%-95% (Eckert and Lien 1999). However, many of the sea turtles do not die as a result of drowning, but rather because the fishermen butcher them in order to get them out of their nets (NMFS SEFSC 2001).

Leatherbacks may be more susceptible to marine debris ingestion than other sea turtle species due to the tendency of floating debris to concentrate in convergence zones that juveniles and adults use for feeding areas (Shoop and Kenney 1992; Lutcavage *et al.* 1997). Investigations of the stomach contents of leatherback sea turtles revealed that a substantial percentage (44% of the 16 cases examined) contained plastic (Mrosovsky 1981). Along the coast of Peru, intestinal contents of 19 of 140 (13%) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items (e.g., jellyfish) and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that plastic objects may resemble food items by their shape, color, size, or even movements as they drift about, and induce a feeding response in leatherbacks.

Summary of Status for Leatherback Sea Turtles
In the Pacific Ocean, the abundance of leatherback sea turtles on nesting beaches has declined dramatically over the past 10 to 20 years. Nesting groups throughout the eastern and western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females and reduced the reproductive success of females that manage to nest (for example, egg poaching) (NMFS and USFWS 2007b). No reliable long term trend data for the Indian Ocean populations are currently available. While leatherbacks are known to occur in the Mediterranean Sea, nesting in this region is not known to occur (NMFS and USFWS 2007b).

Nest counts in many areas of the Atlantic Ocean show increasing trends, including for beaches in Suriname and French Guiana which support the majority of leatherback nesting (NMFS and USFWS 2007b). The species as a whole continues to face numerous threats at nesting and marine habitats. The long term recovery potential of this species may be further threatened by observed low genetic diversity, even in the largest nesting groups like French Guiana and Suriname (NMFS and USFWS 2007b).

Based on its 5-year status review of the species, NMFS and USFWS (2007b) determined that endangered leatherback sea turtles should not be delisted or reclassified as threatened. However, it was also determined that an analysis and review of the species should be conducted in the future to determine whether DPSs should be identified for the leatherback, and what the status of any DPSs should be (NMFS and USFWS 2007b)

3.2.3 Kemp's Ridley Sea Turtles

The Kemp's ridley is one of the least abundant of the world's sea turtle species. In contrast to loggerhead, leatherback, and green sea turtles, which are found in multiple oceans of the world, Kemp's ridleys typically occur only in the Gulf of Mexico and the northwestern Atlantic Ocean (USFWS and NMFS 1992).

The majority of Kemp's ridleys nest along a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; USFWS and NMFS 1992; NMFS and USFWS 2007c). There is a limited amount of scattered nesting to the north and south of the primary nesting beach (NMFS and USFWS 2007c). The number of nesting adult females reached an estimated low of 300 in 1985 (USFWS and NMFS 1992; TEWG 2000; NMFS and USFWS 2007c). Conservation efforts by Mexican and U.S. agencies have aided this species by eliminating egg harvest, protecting eggs and hatchlings, and reducing at-sea mortality through fishing regulations (TEWG 2000). From 1985 to 1999, the number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3% (95% C.I. slope = 0.096-0.130) per year (TEWG 2000). An estimated 5,500 females nested in Tamaulipas over a 3-day period in May 2007 (NMFS and USFWS 2007c).

Kemp's ridleys mature at 10-17 years (Caillouet *et al.* 1995; Schmid and Witzell 1997; Snover *et al.* 2007; NMFS and USFWS 2007c). Nesting occurs from April through July each year with hatchlings emerging after 45-58 days (USFWS and NMFS 1992). Once they leave the nesting beach, neonates presumably enter the Gulf of Mexico where they feed on available S*argassum* and associated infauna or other epipelagic species (USFWS and NMFS 1992). The presence of juvenile turtles along both the U.S. Atlantic and Gulf of Mexico coasts, where they are recruited to the coastal benthic environment, indicates that post-hatchlings are distributed in both the Gulf of Mexico and Atlantic Ocean (TEWG 2000).

The location and size classes of dead turtles recovered by the STSSN suggests that benthic immature developmental areas occur in many areas along the U.S. coast and that these areas may change given resource quality and quantity (TEWG 2000). Foraging areas documented along the U.S. Atlantic coast include Pamlico Sound, Chesapeake Bay, Long Island Sound, Charleston Harbor, and Delaware Bay. Developmental habitats are defined by several characteristics, including coastal areas sheltered from high winds and waves such as embayments and estuaries, and nearshore temperate waters shallower than 50 m (NMFS and USFWS 2007c). The suitability of these habitats depends on resource availability, with optimal environments providing rich sources of crabs and other invertebrates. A wide variety of substrates have been documented to provide good foraging habitat, including seagrass beds, oyster reefs, sandy and mud bottoms, and rock outcroppings (NMFS and USFWS 2007c). Adults are primarily found in nearshore waters of 37 m or less that is rich in crabs and has a sandy or muddy bottom (NMFS and USFWS 2007c).

Next to loggerheads, Kemp's ridleys are the second most abundant sea turtle in Virginia and Maryland state waters, arriving in these areas during May and June (Keinath *et al.* 1987; Musick and Limpus 1997). In the Chesapeake Bay, where the seasonal juvenile population of Kemp's ridley sea turtles is estimated to be 211-1,083 individuals, Kemp's ridleys frequently forage in submerged aquatic grass beds for crabs (Musick and Limpus 1997). Kemp's ridleys consume a variety of crab species, including *Callinectes* sp., *Ovalipes* sp., *Libinia* sp., and *Cancer* sp. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). Upon leaving Chesapeake Bay in autumn, juvenile Kemp's ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined there by juveniles of the same size from North Carolina sounds and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Epperly *et al.* 1995a, 1995b; Musick and Limpus 1997).

Kemp's ridleys face many of the same natural threats as loggerheads, including destruction of nesting habitat from storm events, natural predators at sea, and oceanic events such as cold-stunning. Although cold-stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. For example, as reported in the national STSSN database, in the winter of 1999/2000, there was a major cold-stunning event where 218 Kemp's ridleys, 54 loggerheads, and 5 green sea turtles were found on Cape Cod beaches. Annual cold stun events do not always occur at this magnitude; the extent of episodic major cold stun events may be associated with numbers of turtles utilizing Northeast U.S. waters in a given year, oceanographic conditions, and the occurrence of storm events in the late fall. Although many cold-stunned turtles can survive if found early enough, cold-stunning events can represent a significant cause of natural mortality.

Like other sea turtle species, the severe decline in the Kemp's ridley population appears to have been heavily influenced by a combination of exploitation of eggs and impacts from fishery interactions. From the 1940s through the early 1960s, nests from Ranch Nuevo were heavily exploited, but beach protection in 1966 helped to curtail this activity (USFWS and NMFS 1992). Following World War II, there was a substantial increase in the number of trawl vessels, particularly shrimp trawlers, in the Gulf of Mexico where adult Kemp's ridley sea turtles occur. Information from fishermen helped to demonstrate the high number of turtles taken in these shrimp trawls (USFWS and NMFS 1992). Subsequently, NMFS has worked with the industry to reduce sea turtle takes in shrimp trawls and other trawl fisheries, including the development and use of TEDs. As described in Section 3.1.1 above, there is lengthy regulatory history with regard to the use of TEDs in the U.S. south Atlantic and Gulf of Mexico shrimp fisheries (Epperly and Teas 2002; NMFS 2002b; Lewison *et al.* 2003). The Biological Opinion completed in 2002 concluded that 155,503 Kemp's ridley sea turtles would be taken annually in the fishery with 4,208 of the takes resulting in mortality (NMFS 2002b).

Although changes in the use of shrimp trawls and other trawl gear have helped to reduce mortality of Kemp's ridleys, this species is also affected by other sources of anthropogenic impacts similar to those discussed above. For example, in the spring of 2000, a total of five Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. The cause of death for most of the turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gillnet fishery operating offshore in the preceding weeks. The five Kemp's ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction, since it is unlikely that all of the carcasses washed ashore.

Summary of Status for Kemp's Ridley Sea Turtles
The majority of Kemp's ridleys nest along a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; USFWS and NMFS 1992; NMFS and USFWS 2007c). The number of nesting females in the Kemp's ridley population declined dramatically from the late 1940s through the mid 1980s, with an estimated 40,000 nesting females in a single *arribada* in 1947 and fewer than 250 nesting females in the entire 1985 nesting season (USFWS and NMFS 1992; TEWG 2000). However, the total annual number of nests at Rancho Nuevo gradually began to increase in the 1990s (NMFS and USFWS 2007c). Based on the number of nests laid in 2006 and the remigration interval for Kemp's ridley sea turtles, there were an estimated 7,000-8,000 adult female Kemp's ridley sea turtles in 2006 (NMFS and USFWS 2007c). The number of adult males in the population is unknown but sex ratios of hatchlings and immature ridleys suggest that the population is female biased (NMFS and USFWS 2007c). Based on their 5-year status review of the species, NMFS and USFWS (2007c) determined that Kemp's ridley sea turtles should not be reclassified as threatened under the ESA

3.2.4 Green Sea Turtle

Green sea turtles are distributed circumglobally, and can be found in the Pacific, Indian, and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991b; Seminoff 2004; NMFS and USFWS 2007d). In 1978, the Atlantic population of the green sea turtle was listed as threatened under the ESA, except for the breeding populations in Florida and on the Pacific coast of Mexico, which were listed as endangered. As it is difficult to differentiate between breeding populations away from the nesting beaches, in water all green sea turtles are considered endangered.

Pacific Ocean. Green sea turtles occur in the eastern, central, and western Pacific. Foraging areas are also found throughout the Pacific and along the southwestern U.S. coast (NMFS and USFWS 1998b). Nesting is known to occur in the Hawaiian archipelago, American Samoa, Guam, and various other sites in the Pacific, but none of these are considered large breeding sites (with 2,000 or more nesting females per year) (NMFS and USFWS 1998b). The main nesting sites for the green sea turtle in the eastern Pacific are located in Michoacan, Mexico and in the Galapagos Islands, Ecuador (NMFS and USFWS 2007d). The number of nesting females per year exceeds 1,000 females at each site (NMFS and USFWS 2007d). However, historically, greater than 20,000 females per year are believed to have nested in Michoacan alone (Cliffton *et al.* 1982; NMFS and USFWS 2007d). Thus the current number of nesting females is still far below what has historically occurred.

Historically, green sea turtles were used in many areas of the Pacific for food. They were also commercially exploited and this, coupled with habitat degradation, led to their decline in the Pacific (NMFS and USFWS 1998b). Green sea turtles in the Pacific continue to be affected by poaching, habitat loss or degradation, fishing gear interactions, and fibropapilloma (NMFS and USFWS 1998b; NMFS 2004b).

Indian Ocean. There are numerous nesting sites for green sea turtles in the Indian Ocean. One of the largest nesting sites for green sea turtles worldwide occurs on the beaches of Oman where an estimated 20,000 green sea turtles nest annually (Hirth 1997; Ferreira *et al.* 2003). Based on a review of the 32 Index Sites used to monitor green sea turtle nesting worldwide, Seminoff (2004) concluded that declines in green sea turtle nesting were evident for many of the Indian Ocean Index Sites. While several of these had not demonstrated further declines in the more recent past, only the Comoros Island Index Site in the Western Indian Ocean showed evidence of increased nesting (Seminoff 2004).

Atlantic Ocean. As has occurred in other oceans of its range, green sea turtles were once the target of directed fisheries in the U.S. and throughout the Caribbean. In 1890, over one million lbs of green sea turtles were taken in the Gulf of Mexico green sea turtle fishery (Doughty 1984). However, declines in the turtle fishery throughout the Gulf of Mexico were evident by 1902 (Doughty 1984).

In the western Atlantic, green sea turtles range from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean (Wynne and Schwartz 1999). Green sea turtles occur seasonally in Mid-Atlantic and Northeast waters such as Long Island Sound (Musick and Limpus 1997; Morreale and Standora 1998; Morreale *et al.* 2004), presumably for foraging.

Some of the principal feeding pastures in the western Atlantic Ocean include the upper west coast of Florida, the Florida Keys, and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean coast of Panama, and scattered areas along Colombia and Brazil (Hirth 1971).

Age at maturity for green sea turtles is estimated to be 20-50 years (Balazs 1982; Frazer and Ehrhart 1985; Seminoff 2004). As is the case with the other sea turtle species described above, adult females may nest multiple times in a season and typically do not nest in successive years (NMFS and USFWS 1991b; Hirth 1997).

As is also the case for the other sea turtle species described above, nest count information for green sea turtles provides information on the relative abundance of nesting, and the contribution of each nesting group to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The 5-year status review for the species identified eight geographic areas considered to be primary sites for green sea turtle nesting in the Atlantic/Caribbean, and reviewed the trend in nest count data for each (NMFS and USFWS 2007d). These include: (1) Yucatán Peninsula, Mexico, (2) Tortuguero, Costa Rica, (3) Aves Island, Venezuela, (4) Galibi Reserve, Suriname, (5) Isla Trindade, Brazil, (6) Ascension Island, United Kingdom, (7) Bioko Island, Equatorial Guinea, and (8) Bijagos Archipelago, Guinea-Bissau (NMFS and USFWS 2007d). Nesting at all of these sites was considered to be stable or increasing with the exception of Bioko Island and the Bijagos Archipelago where the lack of sufficient data precluded a meaningful trend assessment for either site (NMFS and USFWS 2007d). Seminoff (2004) likewise reviewed green sea turtle nesting data for eight sites in the western, eastern, and central Atlantic, including all of the above with the exception that nesting in Florida was reviewed in place of Isla Trindade, Brazil. Seminoff (2004) concluded that all sites in the central and western Atlantic showed increased nesting with the exception of nesting at Aves Island, Venezuela, while both sites in the eastern Atlantic demonstrated decreased nesting. These sites are not inclusive of all green sea turtle nesting in the Atlantic Ocean. However, other sites are not believed to support nesting levels high enough that would change the overall status of the species in the Atlantic (NMFS and USFWS 2007d).

By far, the most important nesting concentration for green sea turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007d). Nesting in the area has increased considerably since the 1970s and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007d). The number of females nesting per year on beaches in the Yucatán, at Aves Island, Galibi Reserve, and Isla Trindade number in the hundreds to low thousands, depending on the site (NMFS and USFWS 2007d). In the U.S., certain Florida nesting beaches have been designated index beaches. Index beaches were established to standardize data collection methods and effort on key nesting beaches. The pattern of green sea turtle nesting shows biennial peaks in abundance, with a generally positive trend during the ten years of regular monitoring since establishment of the index beaches in 1989; this is perhaps due to increased protective legislation throughout the Caribbean (Meylan *et al.* 1995).

An average of 5,039 green sea turtle nests were laid annually in Florida between 2001 and 2006 with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007d). Occasional nesting has been documented along the Gulf coast of Florida, at southwest Florida beaches, as well as the beaches in the Florida Panhandle (Meylan *et al.* 1995). More recently, green sea turtle nesting occurred on Bald Head Island, North Carolina (just east of the mouth of the Cape Fear River), on Onslow Island, and at Cape Hatteras National Seashore. Increased nesting has also been observed along the Atlantic coast of Florida, on beaches where only loggerhead sea turtle nesting was observed in the past (Pritchard 1997).

Green sea turtles face many of the same natural threats as loggerhead and Kemp's ridley sea turtles. In addition, green sea turtles appear to be susceptible to fibropapillomatosis, an epizootic disease producing lobe-shaped tumors on the soft portion of a turtle's body. Juveniles are most commonly affected. The occurrence of fibropapilloma tumors may result in impaired foraging, breathing, or swimming ability, potentially leading to death.

As with the other sea turtle species, incidental fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like dredging, pollution, and habitat destruction account for an unknown level of other mortality. Stranding reports indicate that between 200-400 green sea turtles strand annually along the eastern U.S. coast from a variety of causes most of which are unknown (STSSN database). Sea sampling coverage in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green sea turtles.

Summary of Status of Green Sea Turtles

A review of 32 Index Sites1 distributed globally revealed a 48%-67% decline in the number of mature females nesting annually over the last three generations2 (Seminoff 2004). An evaluation of green sea turtle nesting sites was also conducted as part of the 5-year status review of the species (NMFS and USFWS 2007d). Of the 23 nesting groups assessed in that report, 10 were considered to be increasing, 9 were considered stable, and 4 were considered to be decreasing (NMFS and USFWS 2007d). Nesting groups were considered to be doing relatively well (the number of sites with increasing nesting were greater than the number of sites with decreasing nesting) in the Pacific, western Atlantic, and central Atlantic (NMFS and USFWS 2007d). The report also estimates that 108,761-150,521 females nest each year among the 46 sites (NMFS and USFWS 2007d). However, given the late age to maturity for green sea turtles, caution is urged regarding the status for any of the nesting groups since no area has a dataset spanning a full green sea turtle generation (NMFS and USFWS 2007d).

There is cautious optimism that green sea turtle abundance is increasing in the Atlantic Ocean. Seminoff (2004) and NMFS and USFWS (2007d) made comparable conclusions with regard to nesting for four nesting sites in the western Atlantic. Each also concluded that nesting at Tortuguero, Costa Rica represented the most important nesting area for green sea turtles in the western Atlantic and that nesting had increased markedly since the 1970s (Seminoff 2004; NMFS and USFWS 2007d). However, the 5-year review also noted that the Tortuguero nesting stock continued to be affected by ongoing directed take at their primary foraging area in Nicaragua (NMFS and USFWS 2007d). As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like dredging, pollution, and habitat destruction account for an unknown level of other mortality.

4.0 ENVIRONMENTAL BASELINE

Environmental baselines for biological opinions include the past and present impacts of all state, federal or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for this Opinion includes the effects of several activities that may affect the survival and recovery of loggerhead, leatherback, Kemp's ridley, and green sea turtles in the action area. The activities generally fall into one of the following three categories: (1) fisheries, (2) other activities (including vessels) that cause death or otherwise impair a whales and/or turtle's ability to function, and (3) recovery activities associated with reducing impacts to ESA-listed marine mammals and sea turtles.

Many of the fisheries and other activities causing death or injury to sea turtles that are identified in this section have occurred for years, even decades. Similarly, while some recovery activities have been in place for years (*e.g.*, nesting beach protection in portions of sea turtle nesting

---

6 The 32 Index Sites include all of the major known nesting areas as well as many of the lesser nesting areas for which quantitative data are available.

7 Generation times ranged from 35.5 years to 49.5 years for the assessment depending on the Index Beach site.

habitat), others have been undertaken more recently following new information on the impact of certain activities on the species.

The past impacts of each state, Federal, and private action or other human activity in the action area cannot be explained in their entirety. However, to the extent they have manifested themselves at the population level, such past impacts are subsumed in the information presented on the status and trend of each species considered in this Opinion, recognizing that the benefits to each species as a result of recovery activities already implemented may not be evident in the status and trend of the respective population for years given the species age to maturity, and depending on the age class(es) affected.

4.1 Fishery Operations

4.1.1 Federal Fisheries

Commercial and recreational fisheries in the action area employ gear that is known to harass, injure, and/or kill sea turtles. Several federally regulated fisheries that use gillnet, longline, trawl, dredge, and pot/trap gear have been documented as unintentionally capturing, entangling, hooking, entraining, or colliding with sea turtles. In some cases, the sea turtles are harmed, injured, or killed as a result of the interaction. Available information suggests that sea turtles can be captured, entangled, hooked, or entrained in these gear types when the operation of the gear overlaps with the distribution of the species.

Sea turtles are also known to be killed and injured as a result of being struck by vessels on the water. However, for the following reasons, the operation of fishing vessels used in the aforementioned fisheries will have discountable effects on sea turtles. First, fishing vessels operate at relatively slow speeds, particularly when towing or hauling gear. Thus, sea turtles in the path of a fishing vessel would likely be able to move out of the vessel's path before being struck. Second, fishing effort for all of the Federal fisheries within the action area is constrained in some way, either through a limited access permit system or by fishing quotas, thus limiting the amount of time that vessels are on the water. The less the time that vessels are on the water, the less opportunity for vessel collisions with sea turtles. Finally, sea turtles do not occur strictly at or within close proximity to the water surface (Morreale 1999), meaning that they spend part of their time at depths out of range of a collision with boats. For these reasons, the impacts of federally permitted fishing vessels themselves on sea turtles are negligible.

The types of gear used in the Federal fisheries described below are also expected to have an insignificant effect on sea turtle prey and the habitats sea turtles utilize. Turtle prey items such as crabs and mollusks are removed from the marine environment as fisheries bycatch in one or more of the aforementioned fisheries. While some of the bycatch is likely returned to the water dead or injured to the extent that the organisms will shortly die, they would still be available as prey for sea turtles, which are known to eat a variety of live prey as well as scavenge dead organisms (Lutcavage and Musick 1985; Keinath *et al.* 1987; Dodd 1988; Burke *et al.* 1993; Morreale and Standora 2005). The same can be said for the prey of leatherback and green sea turtles, although their prey is not caught as fisheries bycatch nearly as routinely as that of loggerheads and Kemp's ridleys.

Several of the fisheries below use bottom otter trawl gear. The Northeast Region Essential Fish Habitat Steering Committee (NREFHSC), a panel of experts in the fields of benthic ecology, fishery ecology, geology, fishing gear technology, and fisheries gear operations, has previously concluded that the effects of even light weight otter trawl gear would include: (1) the scraping or plowing of the doors on the bottom, sometimes creating furrows along their path; (2) sediment suspension resulting from the turbulence caused by the doors and the ground gear on the bottom; (3) the removal or damage to benthic or demersal species; and (4) the removal or damage to structure forming biota. The panel also concluded that the greatest impacts from otter trawls occur in high and low energy gravel habitats and in hard clay outcroppings, and that sand habitats were the least likely to be impacted (NREFHSC 2002). The action area in which these Federal fisheries occur along the U.S. Atlantic coast includes very few habitats that are purely gravel or hard clay (Amato 1994). Fixed gear (e.g., pots, traps, and sink gillnets) is expected to have less of an effect on bottom habitat than mobile gear. For sea turtles, the effects on habitat due to bottom otter trawl gear would be felt as an effect on their benthic prey species. NMFS believes, the effects on sea turtle prey items are expected to be insignificant.

In the Northeast Region (Maine through Carolinas), formal ESA section 7 consultations have been conducted on the American lobster, Atlantic bluefish, Atlantic mackerel/squid/ butterfish, Atlantic sea scallop, monkfish, northeast multispecies, red crab, spiny dogfish, summer flounder/scup/black sea bass, and tilefish fisheries. An ITS has been issued for the incidental take of sea turtles in each of these fisheries. The ITS reflects the incidental take of sea turtles and other listed species anticipated from the date of the ITS and forward in time.

The only fishery that has been determined by NMFS to reduce the reproduction, numbers, or distribution of ESA-listed sea turtles, and thereby reduce appreciably their likelihood of survival and recovery, is the pelagic longline component of the Atlantic highly migratory species fishery. On June 14, 2001, NMFS released an Opinion that found that the continued operation of the Atlantic pelagic longline fishery was likely to jeopardize the continued existence of both loggerhead and leatherback sea turtles. To avoid jeopardy to these species, a Reasonable and Prudent Alternative (RPA) was developed. The RPA required the closure of the Northeast Distant (NED) Statistical Area of the Atlantic Ocean to pelagic longlining and the enactment of a research program to develop or modify fishing gear and techniques to reduce sea turtle interactions and mortality associated with such interactions. On June 1, 2004, NMFS released another Opinion on the Atlantic pelagic longline fishery which stated that the fishery was still likely to jeopardize the continued existence of leatherback sea turtles. Another RPA was then developed to remove jeopardy. The RPA required that NMFS (1) reduce post-release mortality of leatherbacks, (2) improve monitoring of the effects of the fishery, (3) confirm the effectiveness of the hook and bait combinations that are required as part of the proposed action, and (4) take management action to avoid long-term elevations in leatherback takes or mortality. NMFS stated in the Opinion that this RPA must be implemented in its entirety to avoid jeopardy.

A summary of each fishery that has been subject to section 7 consultation is provided below, but more detailed information can be found in the respective biological opinions. The information describes times and areas where the fishery presently operates in order to qualitatively assess the likelihood of overlap between operation of the fishery and distribution of sea turtles.

As described in Section 1.0, formal ESA Section 7 consultation has also been previously conducted on the Atlantic MSB fishery - a fishery with a history in U.S. Atlantic waters that dates back to at least the 1950s and 1960s and possibly as early as the late 1800s (NEFMC 2003a; NEFSC 2007a). Therefore, the environmental baseline for this action also includes the effects of the past operation of the MSB fishery.

A FMP for the *Atlantic herring fishery* was implemented on December 11, 2000. Three management areas, which may have different management measures, were established under the Herring FMP. Changes to the management of the herring fishery were made in 2007 with the implementation of Amendment 1 to the Herring FMP (72 FR 11252, March 12, 2007). These included making the herring fishery a limited access fishery (NEFMC 2006b). As a result of these changes, effort in the fishery is expected to be reduced or constrained. The ASMFC's Atlantic Herring ISFMP provides measures for the management of the herring fishery in state waters that are complementary to the Federal FMP.

The FMP was most recently reiniated due to Atlantic salmon listing. Sea turtle interactions with gear used in the *Atlantic herring fishery* have not been reported or observed by NMFS observers. During the 1990's, purse seine and mid-water trawl gear accounted for the majority of annual herring landings. However, the gear type accounting for the majority of herring landings changed over the ten-year period from 1995-2005 (NEFMC 2006b). Since 2000, pair trawl gear has accounted for the majority of herring landed each year (NEFMC 2006b). The informal consultation based on the most recent Atlantic salmon and sea turtle observer data and research was analyzed and assessed for possible interactions. The recently (Feb. 9, 2010) completed consultation on the FMP concluded via an informal consultation that sea turtle and Atlantic salmon interactions with the fishing gears used in the fishery are reasonably unlikely to occur.

The *American lobster trap fishery* has been identified as a source of gear causing injuries and mortality of loggerhead and leatherback sea turtles as a result of entanglement in buoy lines of the pot/trap gear (NMFS 2002). Loggerhead or leatherback sea turtles caught/wrapped in the buoy lines of lobster pot/trap gear can die as a result of forced submergence or incur injuries leading to death as a result of severe constriction of a flipper from the entanglement. Given the seasonal distribution of loggerhead sea turtles in Mid-Atlantic and New England waters and the operation of the lobster fishery, loggerhead sea turtles are expected to overlap with the placement of lobster pot/trap gear in the fishery during the months of May through October in waters off of New Jersey through Massachusetts. Compared to loggerheads, leatherback sea turtles have a similar seasonal distribution in Mid-Atlantic and New England waters, but with a more extensive distribution in the Gulf of Maine (Shoop and Kenney 1992; James *et al.* 2005a). Therefore, leatherback sea turtles are expected to overlap with the placement of lobster pot/trap gear in the fishery during the months of May through October in waters off of New Jersey through Maine.

Pot/trap gear has been identified as a gear type causing injuries and mortality of right and humpback whales (Johnson *et al.* 2005; Waring *et al.* 2007; Glass et al. 2008) Large whales are known to become entangled in lines associated with multiple gear types. For pot/trap gear, vertical lines attach buoys to the gear while groundline attach the pots/traps in series. A right whale entanglement in pot/trap gear used in the inshore lobster fishery resulting in death occurred in 2001 (Waring *et al.* 2007). A mortality of a humpback whale in pot/trap gear in the state lobster fishery occurred in 2002 (Waring *et al.* 2007). Other mortalities and serious injuries to ESA-listed cetaceans as a result of pot/trap gear set in the lobster fishery have occurred as reported in Moore *et al.* (2004), Johnson *et al.* (2005), Glass *et al.* (2008). It cannot be determined in all cases whether the gear was set in state waters as part of a state lobster fishery or in federal waters.

American lobsters occur within U.S. waters from Maine to Virginia. They are most abundant from Maine to New Jersey with abundance declining from north to south (ASMFC 1999). Most lobster trap effort occurs in the Gulf of Maine. Maine and Massachusetts produced 90% of the 2006 total U.S. landings of American lobster, with Maine accounting for 79% of these landings (NMFS 2007). Lobster landings in the other New England states as well as New York and New Jersey account for most of the remainder of U.S. American lobster landings. However, declines in lobster abundance and landings have occurred from Rhode Island through New Jersey in recent years. The Mid-Atlantic states from Delaware through North Carolina have been granted *de minimus* status under the ASMFC's Interstate Fishery Management Plan (ISFMP). The ISFMP includes measures to constrain or reduce fishing effort in the lobster fishery. Such measures are of benefit to large whales and sea turtles by reducing the amount of gear (specifically buoy lines) in the water where whales and sea turtles also occur. A consultation on this fishery has been reinitiated for section 7 and is presently ongoing.

The *Atlantic bluefish fishery* has been operating in the U.S. Atlantic for at least the last half century, although its popularity did not heighten until the late 1970s and early 1980s (MAFMC and ASMFC 1998).

The most recent formal consultation on the bluefish fishery was completed on July 2, 1999. An ITS was provided with the 1999 Opinion along with non-discretionary RPMs to minimize the impacts of incidental take. As described in the ITS, up to 6 loggerheads, 6 Kemp's ridleys, and 1 shortnose sturgeon were anticipated to be injured or killed annually as a result of the continued operation of the bluefish fishery. Of the incidental takes exempted by the ITS, no more than 3 loggerheads were anticipated to be killed per year. At the time of the 1999 Opinion, no takes of ESA-listed whales were expected to occur in the bluefish fishery.

The anticipated incidental take of ESA-listed sea turtles and shortnose sturgeon in bluefish fishing gear exempted by the 1999 Opinion was based on observed interactions from Sea Sampling data for gear types targeting or capable of catching bluefish (NMFS 1999a). At the time of the 1999 Opinion, the bluefish fishery was believed to interact with these species given the time and locations where the fishery occurred. Although no incidental takes of ESA-listed sea turtles had been reported in bottom otter trawl gear for trips that were 'targeting' bluefish (where greater than 50% of the catch was bluefish), incidental takes of loggerhead and Kemp's ridley sea turtles were observed in bottom otter trawl gear where bluefish were caught but constituted less than 50% of the catch (NMFS 1999a).

In August 2007, NMFS received an estimate of loggerhead sea turtle bycatch in bottom otter trawl gear used in the bluefish fishery (Memo from K. Murray, Northeast Fisheries Science Center [NEFSC] to L. Lankshear, NERO, Protected Resources Division [PRD]). This information has since been published in a NMFS NEFSC Reference Document (Murray 2008). Using Vessel Trip Report (VTR) data from 2000-2004 and the average annual bycatch of sea turtles as described in Murray (2006), the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the bluefish fishery was estimated to be 3 per year (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD; Murray 2008). The 1999 Opinion anticipated the annual incidental take of 6 loggerhead sea turtles. At the time of its publication, the information presented by Murray (2006) was not believed to represent new information on the effects of the bluefish fishery on loggerheads. However, NMFS has received additional information on the effects of the fishery on sea turtles. The captures of two leatherback sea turtles and one unidentified hard-shelled sea turtle were reported in gillnet gear used in the bluefish fishery in 2003 and 2004, records of which were verified by NMFS in 2007.

Additional information on sea turtle interactions with gillnet gear, including gillnet gear used in the bluefish fishery, has also been recently published by Murray (2009a).

Although NMFS was not aware until 2003 that sea turtle interactions with fishing gear targeting bluefish were likely to occur, there is no information to suggest that sea turtle interactions with bluefish fishing gear are a new event or are occurring at a greater rate than what has likely occurred in the past. To the contrary, the methods used to detect any sea turtle interactions with bluefish fishing gear were insufficient prior to increased observer coverage in recent years. In addition, there have been no known changes to the seasonal distribution of loggerhead sea turtles in the U.S. Atlantic (CETAP 1982; Lutcavage and Musick 1985; Keinath *et al.* 1987; Thompson 1988; Shoop and Kenney 1992; Burke *et al.* 1993, 1994) with the exception of recent studies (Morreale *et al.* 2005; Mansfield 2006), which suggest a decrease rather than an increase in the use of some Mid-Atlantic loggerhead foraging areas for unknown reasons. Therefore, it is likely that the effect of the bluefish fishery on sea turtles, while only quantified and recognized within the last 5 years, has been present for decades.

The commercial bluefish fishery does not typically operate in areas where and at times when large whales occur, however interactions between the whales and bluefish fishery are possible. Right, humpback, and fin whales are known to have been seriously injured and/or killed by gear types used by the bluefish fishery, specifically gillnet gear. Although the gillnet gear has never been traced back to the bluefish fishery specifically, often times the gear responsible can not be identified. The fishery's gear is required to follow regulations set by the ALWTRP.

As a result of the information discussed above, formal consultation on the bluefish fishery was reinitiated on December 18, 2007 to reevaluate the effects of the fishery on ESA-listed whales and sea turtles. The consultation is ongoing.

The *Atlantic mackerel/squid/butterfish fisheries* are managed under a single FMP that includes both the short-finned squid (*Illex illecebrosus*) and long-finned squid (*Loligo pealei*) fisheries. Loggerhead sea turtles are captured in bottom-otter trawl gear used in the *Loligo* squid fishery and may be injured or killed as a result of forced submergence in the gear. The NEFSC, using VTR data from 2000-2004, estimated the average annual take (capture) of loggerhead sea turtles in bottom otter trawl gear used in the Atlantic mackerel, squid, butterfish fisheries to be 62 loggerhead sea turtles a year (Murray 2008). NMFS has reinitiated section 7 consultation on the continued authorization of the mackerel, squid, butterfish fisheries under the Atlantic Mackerel, Squid, Butterfish FMP in light of this information on the capture of loggerhead sea turtles in bottom otter trawl gear used in the fisheries. Gillnets account for a very small amount of landings in the mackerel fishery, and all gillnet gear use by this fishery is subject to the requirements of the ALWTRP

Bottom otter trawl gear is the primary gear type used to land *Loligo* and *Illex* squid. Based on NMFS dealer reports, the majority of *Loligo* and *Illex* squid are fished in the Mid-Atlantic including waters within the action area of this consultation where loggerheads also occur. While squid landings occur year round, the majority of *Loligo* squid landings occur in the fall through winter months while the majority of *Illex* landings occur from June through October (MAFMC 2007); time periods that overlap in whole or in part with the distribution of loggerhead sea turtles in Mid-Atlantic waters.

The *Atlantic sea scallop* fishery is known to capture loggerhead, Kemp's ridley, and green sea turtles in scallop dredge and/or trawl gear used in the fishery, resulting in death or injury. Given the seasonal distribution of sea turtles in New England and Mid-Atlantic waters north of Cape Hatteras, sea turtle distribution is expected to overlap with operation of the scallop fishery from May through November. All observed captures of sea turtles in scallop fishing gear have occurred from June through October. Nearly all observed captures have occurred in Mid-Atlantic waters. No interactions between scallop fishing gear and leatherback sea turtles have been observed by NMFS observers. However, NMFS has determined that leatherbacks could be struck by scallop trawl or dredge gear used in the fishery. The required use of chain mats on scallop dredge gear from May through November in waters south of 41° 09'N is expected to prevent most sea turtles from entering the dredge bag of scallop dredge gear and reduce the likelihood of injury.

The scallop fishery has a long history of operation in Mid-Atlantic, as well as New England waters (NEFMC 1982; 2003). The fishery operates in areas and at times that it has traditionally operated and uses traditionally fished gear (NEFMC 1982; 2003). Effort (in terms of days fished) in the Mid-Atlantic is about half of what it was prior to implementation of the Scallop FMP in the 1990's (NEFSC 2007).

Components of the *highly migratory species (HMS)* Atlantic pelagic fishery for swordfish/tuna/shark in the EEZ occur within the action area for this consultation. Use of pelagic longline in this fishery outside of the action area has resulted in the take of sea turtles. In June 2001, NMFS completed consultation on the HMS pelagic longline fishery and concluded that the Atlantic HMS fisheries, particularly the pelagic longline fisheries that occur outside of the action areas for this Opinion, were likely to jeopardize the continued existence of loggerhead and leatherback sea turtles. An RPA was provided to avoid jeopardy to leatherback and loggerhead sea turtles as a result of operation of the HMS fisheries. Consultation was subsequently reinitiated and a new RPA was developed and implemented following NMFS completion of the Opinion on June 1, 2004. In 2006, the Atlantic HMS pelagic longline fisheries had an estimated 415 interactions with leatherback sea turtles and 561 interactions with loggerhead sea turtles (Fairfield-Walsh and Garrison 2007).

Multiple gear types are used in the *Northeast Multispecies fishery*. However, the gear type of greatest concern is sink gillnet gear that can entangle whales and sea turtles (*i.e.*, in buoy lines and/or net panels). Data indicate that sink gillnet gear has seriously injured or killed North Atlantic right whales, humpback whales, fin whales, loggerhead and leatherback sea turtles. The northeast multispecies sink gillnet fishery has historically occurred from the periphery of the Gulf of Maine to Rhode Island in water depths to 60 fathoms. In recent years, more of the effort in the fishery has occurred in offshore waters and into the Mid-Atlantic. Participation in this fishery has declined since extensive groundfish conservation measures have been implemented. The fishery operates throughout the year with peaks in spring, and from October through February.

Use of gillnet gear in the fishery is affected by measures implemented under the ALWTRP. In the June 2001 Opinion, NMFS determined that the continued operation of the fishery would jeopardize the continued existence of right whales as a result of entanglement in gillnet gear used in the fishery, causing serious injury or death. There have been no confirmed entanglements of right whales in gillnet gear set to target multispecies. However, right and humpback whale entanglements in gillnet gear of unidentified origin have occurred (Johnson *et al.* 2005; Waring *et al.* 2007). A consultation on the FMP has been reinitiated and is presently ongoing.

The *deep-sea red crab fishery* is a pot/trap fishery that occurs in deep waters along the continental slope. The primary fishing zone for red crab, as reported by the fishing industry, is at a depth of 1,300-2,600 feet along the continental shelf in the Northeast region, and is limited to waters north of 35°15.3'N (Cape Hatteras, North Carolina) and south of the Hague Line. Following concerns that red crab could be overfished, an FMP was developed and became effective on October 21, 2002. Section 7 consultation was completed on the fishery during the proposed implementation of the Red Crab FMP (NMFS 2002c). The Opinion concluded that the action was not likely to result in jeopardy to any ESA-listed species under NMFS jurisdiction. An ITS was provided for leatherback and loggerhead sea turtles, which exempts the incidental take of 1 loggerhead and 1 leatherback sea turtle annually as a result of entanglement in groundlines and/or buoy lines associated with the pot/trap gear utilized in the fishery.

The Federal M*onkfish fishery* occurs in all waters under federal jurisdiction from Maine to the North Carolina/South Carolina border. The current commercial fishery operates primarily in the deeper waters of the Gulf of Maine, Georges Bank, and southern New England, and in the Mid-Atlantic. Monkfish have been found in depths ranging from the tide line to 840 meters with concentrations between 70 and 100 meters and at 190 meters. The monkfish fishery uses gillnet and trawl gear types that may entangle protected species.

Gillnet gear used in the monkfish fishery is known to capture ESA-listed sea turtles. Two unusually large stranding events occurred in April and May 2000 during which 280 sea turtles (275 loggerheads and 5 Kemp's ridleys) washed ashore on ocean facing beaches in North Carolina. Although there was not enough information to specifically determine the cause of the sea turtle deaths, there was information to suggest that the turtles died as a result of entanglement with large-mesh gillnet gear. The monkfish gillnet fishery, which uses a large-mesh gillnet, was known to be operating in waters off of North Carolina at the time the stranded turtles would have died. As a result, in March 2002, NMFS published new restrictions for the use of gillnets with larger than 8 inch (20.3 cm) stretched mesh, in Federal waters (3-200 nautical miles) off of North Carolina and Virginia. These restrictions were published in an Interim Final Rule under the authority of the ESA (67 FR 13098) and were implemented to reduce the impact of the monkfish and other large-mesh gillnet fisheries on endangered and threatened species of sea turtles in areas where sea turtles are known to concentrate. Following review of public comments submitted on the Interim Final Rule, NMFS published a Final Rule on December 3, 2002, that established the restrictions permanently on an annual basis.

Use of gillnet gear in the fishery is also affected by measures implemented under the ALWTRP. In the same June 2001 Opinion, NMFS determined that the continued operation of the fishery would jeopardize the continued existence of right whales as a result of entanglement in gillnet gear used in the fishery, causing serious injury or death. There have been no confirmed entanglements of right whales in gillnet gear set to target monkfish. However, right and humpback whale entanglements in gillnet gear of unidentified origin have occurred (Johnson *et al.* 2005; Waring *et al.* 2007). A consultation on this fishery has been reinitated and is presently ongoing.

The *skate fishery* has typically been composed of both a directed fishery and an indirect fishery. The bait fishery is more historical and is a more directed skate fishery than the wing fishery. Vessels that participate in the bait fishery are primarily from Southern New England and direct primarily on little (90%) and winter skate (10%). The wing fishery is primarily an incidental fishery that takes place throughout the region, primarily as bycatch in the fishery for NE multispecies.

Bottom trawl gear accounted for 94.5% of directed skate landings. Gillnet gear is the next most common gear type, accounting for 3.5% of skate landings. There have been no recorded takes of ESA-listed species in the skate fishery. However, given that sea turtle interactions with trawl and gillnet gear have been observed in other fisheries, sea turtle takes in gear used in the skate fishery may be possible where the gear and sea turtle distributions overlap. Section 7 consultation on the Skate FMP was completed July 24, 2003, and concluded that authorization of the skate fishery may adversely affect ESA-listed sea turtles as a result of interactions with (capture in) gillnet and trawl gear. Subsequently, the NEFSC, using VTR data from 2000-2004, estimated the average annual take (capture) of loggerhead sea turtles in bottom otter trawl gear used in the directed skate to be 24 loggerhead sea turtles a year (Murray 2008). Based on this information, NMFS reinitiated section 7 consultation on the continued authorization of the skate fishery. That consultation is on-going.

The management unit for the *Tilefish* FMP is all golden tilefish under U.S. jurisdiction in the Atlantic Ocean north of the Virginia/North Carolina border. Tilefish have some unique habitat characteristics, and are found in a warm water band (47-65° F) at approximately 250 to 1200 feet deep on the outer continental shelf and upper slope of the U.S. Atlantic coast. Because of their restricted habitat and low biomass, the tilefish fishery in recent years has occurred in a relatively small area in the Mid-Atlantic Bight, south of New England and west of New Jersey. Section 7 consultation was completed on this fishery in March 2001. An ITS is provided for loggerhead and leatherback sea turtles.

The primary gear types for the *spiny dogfish fishery* are sink gillnets, otter trawls, bottom longline, and driftnet gear. In the Northwest Atlantic, spiny dogfish range from Florida to Labrador, but are most abundant from Nova Scotia to Cape Hatteras. Spiny dogfish make seasonal inshore-offshore and coastal migrations related to their preferred temperature range (7°-13°C). Spiny dogfish are landed in every state from Maine to North Carolina. Spiny dogfish are landed in all months of the year and throughout a broad area with the distribution of landings varying by area and season. During the fall and winter months, spiny dogfish are captured principally in Mid-Atlantic waters and southward from New Jersey to North Carolina. During the spring and summer months, spiny dogfish are landed mainly in northern waters from New York to Maine. In calendar year 2000, Massachusetts accounted for the largest share of the landings (27.3%), followed by New Jersey (24.7%), North Carolina (16.8%), and New Hampshire (11.1%). Sea turtles can be incidentally captured in all gear sectors of the spiny dogfish fishery. Turtle takes in 2000 included one dead and one live Kemp's ridley. The NEFSC, using VTR data from 2000-2004, estimated the average annual take (capture) of loggerhead sea turtles in bottom otter trawl gear used in the spiny dogfish fishery to be 1 loggerhead sea turtle a year (Murray 2008).

Use of gillnet gear in the fishery is affected by measures implemented under the ALWTRP. In the June 2001, Opinion, NMFS determined that the continued operation of the fishery would jeopardize the continued existence of right whales as a result of entanglement in gillnet gear used in the fishery, causing serious injury or death. There have been no confirmed entanglements of right whales in gillnet gear set to target spiny dogfish. However, right and humpback whale entanglements in gillnet gear of unidentified origin have occurred (Johnson *et al.* 2005; Waring *et al.* 2007). Given recent changes to the ALWTRP affecting the RPA provided with the June 2001 Opinion, NMFS has reinitiated section 7 consultation on the continued authorization of the spiny dogfish fishery. That consultation is on-going.

The *Summer Flounder, Scup and Black Sea Bass fisheries* are known to interact with sea turtles. Summer flounder, scup and black sea bass are managed under one FMP since these species occupy similar habitat and are often caught at the same time. They are present in offshore waters throughout the winter and migrate and occupy inshore waters throughout the summer. The primary gear types used in the summer flounder, scup and black sea bass fisheries are mobile trawl gear, pots and traps, gillnets, pound nets, and handlines.

Summer flounder are taken principally by otter trawl. Since 1980, 70% of the commercial landings of summer flounder have come from the U.S. Exclusive Economic Zone (EEZ). However, large variability in summer flounder landings exist among the states over time and the percent total summer flounder landings taken from the EEZ has varied widely among the states. Since the implementation of the annual commercial landings quota in 1993, the commercial landings have become concentrated during the first calendar quarter of the year with 46% of the landings taken during the first quarter in 2002. In general, over 80% of the commercial landings have come from statistical areas 537-539 (Southern New England), areas 611-616 (New York Bight), areas 621, 622, 625 and 626 (Delmarva region), and areas 631-632 (Norfolk Canyon area). The North Carolina winter trawl fishery accounts for about 99% of summer flounder commercial landings in North Carolina (Terceiro 2003).

The otter trawl is also the principal commercial fishing gear for scup, accounting for an average 74% of the total catch from 1979-2001. The remainder of the commercial landings are taken by floating trap (12%), and hand lines (6%), with paired trawl, pound nets, and pot and traps each contributing 2-3%. About two-thirds of the commercial scup landings for the period 1979-2001 were in Rhode Island (37%) and New Jersey (28%). Landings in New York composed an average of 15% of the total. Landings fluctuated between 7000-10,000 mt from 1974-1986 but have since declined to less than 2000 mt per year (NEFSC 2002).

Otter trawls, which harvested 40% of the black sea bass coastwide, account for most of the black sea bass landings in most states with the exception of Massachusetts, New Jersey, Delaware, and Maryland (from 1990-1999). Fish pots/traps accounted for a significant proportion of landings for the remaining states. In addition, handlines harvested a significant proportion of black sea bass in Massachusetts, Connecticut, New York, Virginia, and North Carolina. Based on landings by month for the period 1990-1999, most black sea bass were harvested from January-June with peak landings in March and May. Massachusetts, New York, and Maryland had peak landings from April-August while landings for all states peaked in the winter months. Activity at the ports indicates that 57% of total black sea bass commercial landings occurred at ports within 5 states: Massachusetts, Rhode Island, New Jersey, Maryland, and Virginia (MAFMC 2002).

Significant measures have been developed to reduce the take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which would include fisheries for other species like scup and black sea bass) by requiring the use of TEDs throughout the year for trawl nets fished from the North Carolina/South Carolina border to Oregon Inlet, NC and seasonally (March 16-January 14) for trawl vessels fishing between Oregon Inlet, NC and Cape Charles, VA. Based on the occurrence of gillnet entanglements in other fisheries, the gillnet portion of this fishery could entangle endangered whales and sea turtles. The pot gear and staked trap sectors could also entangle whales and sea turtles. Use of pot/trap gear in the black sea bass fishery must comply with measures implemented under the ALWTRP, such as the use of sinking groundline.

The NEFSC, using VTR data from 2000-2004, estimated the average annual take (capture) of loggerhead sea turtles in bottom otter trawl gear used in the summer flounder, scup, black sea bass fisheries to be 192 loggerhead sea turtles a year (Murray 2008). This information met the triggers for reinitiating consultation on the continued authorization of the summer flounder, scup, black sea bass fisheries. Therefore, the consultation that was already in progress to consider the effects of these fisheries on ESA-listed whales was amended to include consideration of the effects of these fisheries on ESA-listed sea turtles.

On December 2, 2002, NMFS completed an Opinion for *shrimp trawling in the southeastern U.S.* under proposed revisions to the TED regulations (68 FR 8456, February 21, 2003). This Opinion determined that the shrimp trawl fishery under the revised TED regulations may adversely affect but would not jeopardize the continued existence of any sea turtle species (NMFS 2002b). This determination was based, in part, on the Opinion's analysis that showed that the revised TED regulations were expected to reduce shrimp trawl related mortality by 94% for loggerheads and 97% for leatherbacks. The ITS included with the Opinion exempted the annual incidental take of up to 163,160 loggerheads (3,948 mortalities), 3,090 leatherbacks (80 mortalities), 155,503 Kemp's ridleys (4,208 mortalities), and 18,757 greens (514 mortalities).

Recently, however, NMFS has estimated that the annual take levels and mortalities of sea turtles in the Gulf of Mexico shrimp fishery are significantly lower than what is exempted by the 2002 Opinion. In addition to improvements in TED designs and TED enforcement, interactions between sea turtles and the shrimp fishery have also been declining because of reductions in fishing effort unrelated to fisheries management actions. The 2002 Opinion take estimates are based in part on fishery effort levels. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of recent hurricanes in the Gulf of Mexico have all impacted the shrimp fleets; in some cases reducing fishing effort by as much as 50% for offshore waters of the Gulf of Mexico (GMFMC 2007). As a result, sea turtle interactions and mortalities in the Gulf of Mexico, most notably for loggerheads and leatherbacks, have been substantially less than projected in the 2002 Opinion. For the U.S. south Atlantic shrimp fishery, there is currently no new information on the number of takes and mortalities occurring annually, although NMFS is currently researching this as well.

On August 16, 2010, NMFS reinitiated formal section 7 consultation on the shrimp trawl fishery in the southeastern U.S. to reanalyze its effects on sea turtles. This was primarily due to the after-effects of the April 20, 2010 BP Deepwater Horizon oil spill, from which NMFS has documented extraordinarily high numbers of sea turtle strandings in the Gulf of Mexico, particularly Mississippi Sound. NMFS suspects that much of the increased level of strandings is attributable to shrimp fishing activity as there is recent evidence of a lack of compliance with TED regulations and tow time provisions. In addition, there is also new information that trawl CPUE of sea turtles in Louisiana nearshore waters is elevated. That consultation is ongoing.

4.1.2 Non-Federally Regulated Fisheries

Several trap/pot fisheries, gillnet and trawl fisheries for non-federally regulated species do occur in the action area. The amount of gear contributed to the environment by these fisheries is unknown. In most cases, there is no or very little observer coverage of these fisheries and the extent of interactions with ESA-listed species is unknown.

Nearshore and inshore gillnet fisheries occur throughout the Mid- and South Atlantic in state waters from Connecticut through Florida; areas where sea turtles also occur. Captures of sea turtles in these fisheries have been reported (NMFS SEFSC 2001). Two, 10-14 inch (25.6-35.9 cm) mesh gillnet fisheries, the black drum and sandbar shark gillnet fisheries, occur in Virginia state waters along the tip of the eastern shore. These fisheries may capture or entangle sea turtles given the gear type, but no interactions have been observed. Similarly, small mesh gillnet fisheries occurring in Virginia state waters are suspected of capturing or entangling sea turtles, but no interactions have been observed.

In North Carolina, a large-mesh gillnet fishery for *summer and southern flounder* in the southern portion of Pamlico Sound was found to contribute to captures of sea turtles in gillnet gear. In particular, the North Carolina inshore fall southern flounder gillnet fishery was identified as a source of large numbers of sea turtle mortalities in 1999 and 2000, especially loggerhead sea turtles. In 2000, 2001, and 2002, NMFS issued an ESA section 10 permit to the North Carolina Department of Marine Fisheries (NCDMF) for the take of sea turtles in the Pamlico Sound large-mesh gillnet fishery and provided mitigative measures for the southern flounder fishery. Subsequently, sea turtle mortalities in these fisheries were drastically reduced. The reduction of sea turtle mortalities in these fisheries reduces the negative effects these fisheries have on the environmental baseline. NMFS issued another ESA section 10 permit to the NCDMF in 2005 covering incidental takes through 2010. As described in section 4.4.1 below, NMFS has also taken regulatory action to address the potential for sea turtle interactions with gillnet gear with ≥7 inch (17.9 cm) stretched mesh fished in Federal waters off of North Carolina and Virginia.

Strict regulations are in place for nearshore gillnetting off South Carolina, Georgia, and Florida as well. Georgia and South Carolina prohibit gillnets for all but the shad fishery, and Florida banned all but very small nets in state waters. Although many states have imposed strict regulations on gillnetting, the practice still occurs off some states' waters and in Federal waters. The nearshore and inshore gillnet fisheries off North Carolina are of particular concern due to the incidental captures (both lethal and non-lethal) of loggerhead, leatherback, Kemp's ridley, and green sea turtles (W. Teas, pers. comm., J. Braun-McNeill pers. comm.). In June 2009, 11 sea turtle captures (6 greens, 3 Kemp's ridleys, and 2 loggerheads) occurred over a one-week period in the southern flounder anchored sink gillnet fishery in Core Sound, North Carolina (NEFSC Fisheries Sampling Branch [FSB] database). Illegal gillnet incidental captures have also been reported in South Carolina and Florida (NMFS SEFSC 2001).

An *Atlantic croaker fishery* using trawl gear also occurs within the action area and turtle takes have been observed in the fishery. Between 1996 and 1998, five turtles (four loggerheads and one unidentified species) were taken in otter trawls targeting croaker. In October 2004, observers documented the capture of two loggerhead sea turtles in Atlantic croaker trawl gear operating off Virginia, north of Cape Charles. Both turtles were released alive and uninjured (NEFSC, Fisheries Observer Program website). A humpback whale mortality was recorded in 2001 as a result of entanglement in sink gillnet croaker gear (Waring *et al.* 2007).

The *weakfish fishery* occurs in both state and Federal waters, but the majority of commercially and recreationally caught weakfish are caught in state waters (ASMFC 2002). Commercial gears include gillnets, pound nets, haul seines, and trawls, with the majority of landings occurring in the fall and winter months (ASMFC 2002). Weakfish landings were dominated by the trawl fishery through the mid-1980s after which gill net landings began to account for most weakfish landed (ASMFC 2002). North Carolina has accounted for the majority of the annual landings since 1972 while Virginia ranks second, followed by New Jersey (ASMFC 2002). As described in section 3.2.1, sea turtle bycatch in the weakfish fishery has occurred (Murray 2006). Seven of the sixty-six observed loggerhead sea turtle interactions in bottom otter trawl gear fished in Mid-Atlantic waters during the period 1994-2004 were on vessels targeting weakfish. Murray estimated that 4 loggerhead sea turtles were taken in the trawl sector of the fishery. Since observer coverage was low and the fishery uses other gear types known to incidentally take sea turtles, the incidental take of sea turtles in the fishery is likely to have been higher than that which was observed for just the trawl sector.

A *whelk fishery* using pot/trap gear is known to occur in several parts of the action area, including waters off Maine, Connecticut, Massachusetts, Delaware, Maryland, and Virginia. Landings data for Delaware suggests that the greatest effort in the whelk fishery for waters off of that state occurs in the months of July and October; times when sea turtles are present. Various crab fisheries using pot/trap gear also occur in federal and state waters such as horseshoe crab and blue crab.

Sea turtle takes in the Virginia pound net fishery have been observed. Pound nets with large-mesh leaders set in the Chesapeake Bay have been observed to (lethally) take turtles as a result of entanglement in the pound net leader. As described in section 4.4.4 below, NMFS has taken regulatory action to address turtle takes in the Virginia pound net fishery.

Various *crab fisheries* using pot/trap gear occur in federal and state waters such as horseshoe crab, green crab, blue crab, and Jonah crab. Effort in the latter is currently limited to some extent by trap limits set for the lobster fishery since many Jonah crab fishers are also federally-permitted lobster fishers and Jonah crabs are collected using lobster gear. However, there is interest in developing a separate fishery. If the Jonah crab fishery were to develop exclusive of the lobster fishery, there is a potential for a significant amount of trap/pot gear to be added to the environment. In 2001, Maine's Department of Marine Resources requested an exempted fisheries permit (EFP) from NMFS that would allow up to 100 federally permitted lobster fishers to set additional (modified) lobster traps in federal waters off Maine in order to determine the trap efficiency at catching Jonah crabs while excluding lobster. Formal section 7 consultation was conducted on the proposed action and concluded that the Jonah crab EFP was likely to jeopardize the continued existence of right whales. An RPA was provided to avoid the likelihood that the Jonah crab experimental fishery will jeopardize the continued existence of the endangered right whale. Given that entanglements of right whales and humpback whales in gear of unknown origin and in gear from other pot/trap fisheries continue to occur, NMFS recently revised the List of Fisheries to include the Category II "Atlantic mixed species trap/pot fishery" (68 FR 41725, July 15, 2003). The Jonah crab trap fishery has been placed into this category. NMFS has recently included this fishery under the coverage of the ALWTRP.

In addition to pot/trap gear, trawl and pound net gear can also pose a problem for sea turtles. Bottom trawl fisheries for *horseshoe crab* are suspected of taking sea turtles off Delaware (Spotila *et al.* 1998). Leatherbacks are also known to have been taken in trawls operating in Rhode Island state waters, and are suspected as having been taken in trawl gear operating in Mid-Atlantic state waters. In addition to these, NMFS is also concerned about the take of sea turtles in the pound net fishery in Virginia.

The *Virginia pound net fishery* has also been documented as a source of sea turtle interactions. Pound nets with large-mesh leaders set in the Chesapeake Bay have been observed to (lethally) take turtles as a result of entanglement in the pound net leader. NMFS, therefore, published an interim final rule on June 17, 2002, that included seasonal gear requirements for the use of such leaders in the Chesapeake Bay to address these sea turtle interactions (67 FR 41196). Ongoing turtle impingements problems were dealt with the issuance of a new final rule (69 FR 24997, May 5, 2004).

Incidental captures of loggerheads in fish traps set off Florida have also been reported (W. Teas, pers. comm.). Although no incidental captures have been documented from fish traps set off North Carolina, they are another potential anthropogenic impact to loggerheads and other sea turtles. Long haul seines and channel nets in North Carolina are known to incidentally capture loggerhead and other sea turtles in the sounds and other inshore waters (J. Braun-McNeill, pers. comm.). No lethal takes have been reported (NMFS SEFSC 2001).

Observations of state recreational fisheries have shown that loggerhead, leatherback, and green sea turtles are known to bite baited hooks, and loggerheads frequently ingest the hooks. Hooked sea turtles have been reported by the public fishing from boats, piers, beaches, banks, and jetties, and from commercial fishermen fishing for snapper, grouper, and sharks with both single rigs and bottom longlines (NMFS SEFSC 2001). A summary of known impacts of hook-and-line incidental captures to loggerhead sea turtles can be found in the TEWG (1998, 2000) reports.

4.2 Vessel and Military Activities

Potential sources of adverse effects from Federal vessel operations in the action area include operations of the U.S. Navy (USN) and Coast Guard (USCG), the Environmental Protection Agency (EPA), the Army Corps of Engineers (ACOE), and NOAA. NMFS has conducted formal consultations with the USCG, and the USN on their vessel operations. Through the section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. At the present time, however, there is the potential for some level of interaction. Refer to the biological opinions for the USCG (NMFS 1995) and the USN (NMFS 1996, 1997a) for details on the scope of vessel operations for these agencies and conservation measures being implemented as standard operating procedures.

The USN consultations referenced above only addressed operations out of Mayport, Florida, and the potential exists for USN vessels to adversely affect sea turtles when they are operating in other areas within the range of these species. Similarly, operations of vessels by other Federal agencies within the action area (NOAA, EPA, ACOE) may adversely affect sea turtles. However, vessel activities of those agencies are limited in scope, as they operate a limited number of vessels or are engaged in research/operational activities.

Additional activities including ordnance detonation also affect listed species of sea turtles. Section 7 consultations were conducted for USN aerial bombing training in the ocean off the southeast U.S. coast, involving drops of live ordnance (500 and 1,000-lb bombs) (NMFS 1997a), and the operation of the USCG's boats and cutters in the U.S. Atlantic (NMFS 1995). These consultations determined that each activity was likely to adversely affect sea turtles but would not jeopardize their continued existence. An ITS was issued for each activity. USN aerial bombing training activities were estimated to have the potential to injure or kill, annually, 84 loggerheads, 12 leatherbacks, and 12 greens or Kemp's ridleys, in combination (NMFS 1997a). Operation of the USCG's boats and cutters in the U.S. Atlantic, meanwhile, was estimated to take no more than one individual sea turtle—of any species—per year (NMFS 1995).

NMFS has also conducted section 7 consultations on USN explosive ordnance disposal, mine warfare, sonar testing (e.g., SURTASS), and other major training exercises (e.g., bombing, Naval gunfire, combat search and rescue, anti-submarine warfare, and torpedo and missile exercises) in several areas of the Atlantic Ocean. These consultations determined that the proposed activities may adversely affect but would not jeopardize the continued existence of ESA-listed sea turtles.

Potential adverse effects from federal vessel operations in the action area of this consultation include operations of the U.S. Navy (USN) and the U.S. Coast Guard (USCG), which maintain the largest federal vessel fleets, the Environmental Protection Agency (EPA), the Army Corps of Engineers (ACOE), and NOAA. NMFS has conducted formal consultations with the USCG, the USN and is currently in early phases of consultation with other federal agencies on their vessel operations (*e.g.*, NOAA research vessels). Through the Section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid adverse effects to listed species. At the present time, however, there is the potential for some level of interaction.

4.3 Other Activities

4.3.1 Hopper Dredging

The construction and maintenance of federal navigation channels and sand mining ("borrow") areas have also been identified as sources of sea turtle mortality. Hopper dredges move relatively rapidly (compared to sea turtle swimming speeds) and can entrain and kill sea turtles, presumably as the drag arm of the moving dredge overtakes the slower moving sea turtle. Along the Atlantic coast of the southeastern U.S., NMFS estimates that annual observed injury or mortality of sea turtles from hopper dredging may reach 35 loggerhead, 7 green, 7 Kemp's ridley, and 2 hawksbill sea turtles (NMFS 1997b).

The Sandbridge Shoal is an approved Minerals Management Service borrow site located approximately 3 miles off Virginia Beach. This site has been used in the past for both the Navy's Dam Neck Annex beach renourishment project and the Sandbridge Beach Erosion and Hurricane Protection Project, and is likely to be used in additional beach nourishment projects in the future. The Sandbridge Beach Erosion and Hurricane Protection Project involved hopper dredging of approximately 972,000 cubic yards (cy) of sand during the first year of the project and an anticipated 500,000 cy every two years thereafter. NMFS completed section 7 consultation on this project in April 1993, and anticipated the take of eight loggerhead turtles or one Kemp's ridley or green turtle. Actual dredging did not begin until May 1998, and no sea turtle takes were observed during the 1998 dredge cycle. In June 2001, the ACOE indicated that the next dredge cycle, which was scheduled to begin in the summer of 2002, would require 1.5 million cy of sand initially, with an anticipated 1.1 million cy every two years thereafter. Although the volume of sand had increased from the previous cycle, NMFS reduced the ITS to five loggerheads and one Kemp's ridley or green turtle due to the lack of observed takes in the previous cycle, along with the levels of anticipated and observed take in hopper dredging projects in nearby locations.

NMFS completed section 7 consultation on the Navy's Dam Neck Annex beach nourishment project in January 1996, which involved the removal of 635,000 cy of material beginning in 1996 and continuing on a 12-year cycle thereafter. NMFS anticipated the take of ten loggerheads and one Kemp's ridley or green sea turtle during each dredge cycle. However, no takes were observed during the 1996 cycle. The Navy reinitiated consultation on June 27, 2003, based on an accelerated dredge cycle (from 12 years to 8 years), an increase in the volume of sand required, and new information on the status of loggerhead sea turtles since the original Opinion was issued in 1996. The consultation was concluded on December 12, 2003, and anticipated the take of four loggerheads and one Kemp's ridley or green sea turtle during each dredge cycle. NMFS concluded that this level of take was not likely to jeopardize the continued existence of any of these species.

4.3.2 Maritime Industry

Private and commercial vessels, including fishing vessels, operating in the action area of this consultation also have the potential to interact with sea turtles. The effects of fishing vessels, recreational vessels, or other types of commercial vessels on listed species may involve disturbance or injury/mortality due to collisions or entanglement in anchor lines. It is important to note that minor vessel collisions may not kill an animal directly, but may weaken or otherwise affect it so it is more likely to become vulnerable to effects such as entanglements. Listed species or critical habitat may also be affected by fuel oil spills resulting from vessel accidents. Fuel oil spills could affect animals directly or indirectly through the food chain. Fuel spills involving fishing vessels are common events. However, these spills typically involve small amounts of material that are unlikely to adversely affect listed species. Larger oil spills from fishing vessels may result from accidents, although these events would be rare and involve small areas. No direct adverse effects on listed species or critical habitat resulting from fishing vessel fuel spills have been documented.

4.3.3 Pollution

Sources of pollutants in coastal regions of the action area include atmospheric loading of pollutants such as PCBs, storm water runoff from coastal towns, cities and villages, runoff into rivers emptying into bays, groundwater discharges and sewage treatment effluent, and oil spills.

Nutrient loading from land-based sources such as coastal community discharges is known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effect to larger embayments is unknown. Contaminants could indirectly degrade habitat if pollution and other factors reduce the food available to marine animals.

In feeding areas of the northeast such as the Massachusetts Bay area, the dominant circulation patterns make it probable that pollutant inputs into Massachusetts Bay will affect Cape Cod Bay's right whale critical habitat. Sources of pollutants in the Gulf of Maine and other coastal regions include atmospheric loading of pollutants such as PCB's, storm water runoff from coastal towns, cities and villages, runoff into rivers emptying into bays, groundwater discharges and sewage treatment effluent, and oil spills. A present concern, not yet completely defined, is the possibility of habitat degradation in Massachusetts and Cape Cod Bays due to the Massachusetts Bay Disposal Site (MBDS) located 9.5 miles east of Deer Island. The MBDS began discharging secondary sewage effluent into Massachusetts Bay in 2000 about 16 miles from designated right whale critical habitat. NMFS concluded in a 1993 biological opinion that the discharge of sewage at the MBDS may affect, but is not likely to jeopardize, the continued existence of any listed or proposed species or destroy or adversely modify critical habitat under NMFS jurisdiction. However, scientific uncertainties remain about the potential unforeseen impacts to the marine ecosystem, the food chain, and endangered species. Therefore, post-discharge monitoring is being conducted by the Massachusetts Water Resources Authority. The Center for Costal Studies, Provincetown, MA has been conducting outfall discharge monitoring studies to investigate if habitat degradation in Cape Cod Bay was occurring or if the food chain was being degraded or altered in any way. While this does not appear to have happened, scientists at the Center will continue to evaluate the situation (Jamus Collier pers. comm.). The Center for Coastal Studies is currently developing a comprehensive research paper documenting and presenting their results.

4.3.4 Catastrophic events

An increase in commercial vessel traffic/shipping increases the potential for oil/chemical spills. The pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo *et al.* 1986). There have been a number of documented oil spills in the northeastern U.S. Oil spills outside the action area also have the potential to affect ESA-listed species that occur within the action area. For instance, on April 20, 2010 the Deepwater Horizon oil spill occurred in the Gulf of Mexico off the coast of Louisiana. As ESA-listed species (e.g., loggerhead and Kemp's ridley sea turtles) are known to migrate through, forage, and/or nest along the coastal waters of the Gulf of Mexico, the oil spill is likely to affect their populations; however, because all the information on sea turtle and other ESA-listed species' stranding, deaths, and recoveries has not yet been documented, the effects of the oil spill on the their populations cannot be determined at this time.

4.3.5 Global Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities - frequently referred to in layman's terms as "global warming". Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency's climate change webpage provides basic background information on these and other measured or anticipated effects
(see www. epa.gov/climatechange/index.html). Activities in the action area that may have contributed to global warming include the combustion of fossil fuels by vessels.

Sea Turtles

The effects of global climate change on sea turtles is typically viewed as being detrimental to the species (NMFS and USFWS 2007a; 2007b; 2007c; 2007d). It is believed that increases in sea level, approximately 4.2 mm per year until 2080, have the potential to remove available nesting beaches, particularly on narrow low lying coastal and inland beaches and on beaches where coastal development has occurred (Church *et al.* 2001; IPCC 2007; Nicholls 1998; Fish *et al.* 2005; Baker *et al.* 2006; Jones *et al.* 2007; Mazaris *et al.* 2009). Additionally, global climate change may affect the severity of extreme weather (e.g., hurricanes), with more intense storms expected, which may result in the loss/erosion of or damage to shorelines, and therefore, the loss of potential sea turtle nests and/or nesting sites (Goldenburg *et al.* 2001; Webster *et al.* 2005; IPCC 2007). The cyclical loss of nesting beaches resulting from extreme storm events may then result in a decrease in hatching success and hatchling emergence (Martin 1996; Ross 2005; Pike and Stiner 2007; Prusty *et al.* 2007; Van Houton and Bass 2007). However, there is evidence that, depending on the species, sea turtles species with lower nest site fidelity (i.e., leatherbacks) would be less vulnerable to storm related threats than those with a higher site fidelity (i.e., loggerheads). In fact, it has been reported that sea turtles in Guiana are able to maintain successful nesting despite the fact that between nesting years some beaches they once nested on have disappeared, suggesting that sea turtle species may be able to behavioral adapt to such changes (Pike and Stiner 2007; Witt *et al.* 2008; Plaziat and Augustinius 2004; Girondot and Fretey 1996; Rivalan *et al.* 2005; Kelle *et al.* 2007).

Changes in water temperature are also expected as a result of global climate change. Changes in water temperature are expected affect water circulation patterns perhaps even to the extent that the Gulf Stream is disrupted, which would have profound effects on every aspect of sea turtle life history from hatching success, oceanic migrations at all life stages, foraging, and nesting. (Gagosian 2003; NMFS and USFWS 2007a; 2007b; 2007c; 2007d; Rahmstorf 1997, 1999; Stocker and Schmittner 1997). Thermocline circulation patterns are expected to change in intensity and direction with changes in temperature and freshwater input at the poles (Rahmstorf 1997; Stocker and Schmittner 1997), which will potentially affect not only hatchlings, which rely on passive transport in surface currents for migration and dispersal but also pelagic adults (i.e., leatherbacks) and juveniles, which depend on current patterns and major frontal zones in obtaining suitable prey, such as jellyfish (Hamann *et al.* 2007; Hawkes *et al.* 2009).

Changes in water temperature may also affect prey availability for species of sea turtles. Herbivorous species, such as the green sea turtle, depend primarily on sea grasses as their forage base. Sea grasses could ultimately be negatively affected by increased temperatures, salinities, and acidification of coastal waters (Short and Neckles 1999; Bjork 2008), as well as increased runoff due the expected increase in extreme storm events as a result of global climate change. These alterations of the marine environment due to global climate change could ultimately affect the distribution, physiology, and growth rates of sea grasses, potentially eliminating them from particular areas. However, the magnitude of these effects on seagrass beds, and therefore green sea turtles, are difficult to predict, although some populations of green sea turtles appear to specialize in the consumption of algae (Bjorndal 1997) and mangroves (Limpus and Limpus 2000) and as such, green sea turtles may be able to adapt their foraging behavior to the changing availability of sea grasses in the future. Omnivorous species, such as Kemp's ridley and loggerhead sea turtles, may face changes to benthic communities as a result of changes to water temperature; however, these species are probably less likely to suffer shortages of prey than species with more specific diets (i.e., green sea turtles) (Hawkes *et al.* 2009).

Several studies have also investigated the effects of changes in sea surface temperature and air temperatures on turtle reproductive behavior. For loggerhead sea turtles, warmer sea surface temperatures in the spring have been correlated to an earlier onset of nesting (Weishampel *et al.* 2004; Hawkes *et al.* 2007), shorter internesting intervals (Hays *et al.* 2002), and a decrease in the length of the nesting season (Pike *et al.* 2006). Green sea turtles also exhibited shorter internesting intervals in response to warming water temperatures (Hays *et al.* 2002).

Air temperatures also play a role in sea turtle reproduction. In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25-35° C (Ackerman 1997). Based on modeling done of loggerhead sea turtles, a 2° C increase in air temperature is expected to result in a sex ratio of over 80% female offspring for loggerhead nesting beaches in the vicinity of Southport, NC. Farther to the south at Cape Canaveral, Florida, a 2°C increase in air temperature would likely result in production of 100% females while a 3°C increase in air temperature would likely exceed the thermal threshold of turtle clutches (i.e., greater than 35° C) resulting in death (Hawkes *et al.* 2007). Glen et al. (2003) also reported that, for green sea turtles, incubation temperatures also appeared to affect hatchling size with smaller turtles produced at higher incubation temperatures; however, it is unknown whether this effect is species specific and what impact it has on the survival of the offspring. Thus changes in air temperature as a result of global climate change may alter sex ratios and may reduce hatchling production in the most southern nesting areas of the U.S. (Hawkes et al. 2007; Hamann *et al.* 2007). Given that the south Florida nesting group is the largest loggerhead nesting group in the Atlantic (in terms of nests laid), a decline in the success of nesting as a result of global climate change could have profound effects on the abundance and distribution of the loggerhead species in the Atlantic, including the action area; however; variation of sex ratios to incubation temperature between individuals and populations is not fully understood and as such, it is unclear whether sea turtles will (or can) adapt behaviorally to alter incubation conditions to counter potential feminization or death of clutches associated with water temperatures (e.g., choosing nest sites that are located in cooler areas, such as shaded areas of vegetation or higher latitudes; nesting earlier or later during cooler periods of the year) (Hawkes *et al.* 2009).

Ocean acidification related to global warming would also reasonably be expected to negatively affect sea turtles. The term "ocean acidification" describes the process of ocean water becoming corrosive as a result of carbon dioxide (CO_2) being absorbed from the atmosphere. The absorption of atmospheric CO_2 into the ocean lowers the pH of the waters. Evidence of corrosive water caused by the ocean's absorption of CO_2 was found less than 20 miles off the west coast of North America during a field study from Canada to Mexico in the summer of 2007 (Feely *et al.* 2008). This was the first time "acidified" ocean water was found on the continental shelf of western North America. While the ocean's absorption of CO_2 provides a great service to humans by significantly reducing the amount of greenhouse gases in the atmosphere and decreasing the effects of global warming, the resulting change in ocean chemistry could adversely affect marine life, particularly organisms with calcium carbonate shells such as corals, mussels, mollusks, and small creatures in the early stages of the food chain (*e.g.*, plankton). A number of these organisms serve as important prey items for sea turtles.

Although potential effects of climate change on sea turtle species are currently being addressed, fully understanding the effects of climate change on listed species of sea turtles will require development of conceptual and predictive models of the effects of climate change on sea turtles, which to date are still being developed and will depend greatly on the continued acquisition and maintenance of long-term data sets on sea turtle life history and responses to environmental changes. Until such time, the type and extent of effects to sea turtles as a result of global climate change are will continue to be speculative and as such, the effects of these changes on sea turtles cannot, for the most part, be accurately predicted at this time.

4.4 Reducing Threats to ESA-listed Sea Turtles

4.4.1 Final Rules for Large-Mesh Gillnets

In March 2002, NMFS published new restrictions for the use of gillnets with larger than 8 inch (20.3 cm) stretched mesh, in Federal waters (3-200 nautical miles) off of North Carolina and Virginia. These restrictions were published in an Interim Final Rule under the authority of the ESA (67 FR 13098) and were implemented to reduce the impact of the monkfish and other large-mesh gillnet fisheries on ESA-listed sea turtles in areas where sea turtles are known to concentrate. Following review of public comments submitted on the Interim Final Rule, NMFS published a Final Rule on December 3, 2002, that established the restrictions on an annual basis. As a result, gillnets with larger than 8 inch stretched mesh are not allowed in Federal waters (3-200 nautical miles) in the areas described as follows: (1) north of the North Carolina/South Carolina border at the coast to Oregon Inlet at all times, (2) north of Oregon Inlet to Currituck Beach Light, NC from March 16 through January 14, (3) north of Currituck Beach Light, NC to Wachapreague Inlet, VA from April 1 through January 14, and (4) north of Wachapreague Inlet, VA to Chincoteague, VA from April 16 through January 14. Federal waters north of Chincoteague, VA are not affected by these new restrictions although NMFS is looking at additional information to determine whether expansion of the restrictions are necessary to protect sea turtles as they move into northern Mid-Atlantic and New England waters. These measures are in addition to Harbor Porpoise Take Reduction Plan measures that prohibit the use of large-mesh gillnets in southern Mid-Atlantic waters (territorial and federal waters from Delaware through North Carolina out to 72° 30'W longitude) from February 15-March 15, annually.

NMFS has also issued a rule addressing takes of sea turtles in gillnet gear fished in the southern flounder fishery in Pamlico Sound. NMFS issued a final rule (67 FR 56931), effective September 3, 2002, that closes the waters of Pamlico Sound, NC, to fishing with gillnets with a mesh size larger than 4 ¼ inch (10.8 cm) stretched mesh from September 1 through December 15 each year to protect migrating sea turtles. The closed area includes all inshore waters of Pamlico Sound south of 35° 46.3' N. lat., north of 35° 00' N. lat., and east of 76° 30' W. long.

4.4.2 Final Rule for Larger TED Openings

On February 21, 2003, NMFS issued a final rule to amend regulations protecting sea turtles to enhance their effectiveness in reducing sea turtle mortality resulting from shrimp trawling in the Atlantic and Gulf Areas of the southeastern United States. TEDs have proven to be effective at excluding sea turtles from shrimp trawls. However, NMFS determined that modifications to the design of TEDs needed to be made to exclude leatherbacks as well as large benthic immature and sexually mature loggerhead and green turtles. In addition, several previously approved TED designs did not function properly under normal fishing conditions. Therefore, NMFS disallowed these TEDs (*e.g.*, weedless TEDs, Jones TEDs, hooped hard TED, and the use of accelerator funnels) as described in the final rule. Finally, the rule also required modifications to the trynet and bait shrimp exemptions to the TED requirements to decrease mortality of sea turtles.

4.4.3 TED requirements for the summer flounder fishery

As mentioned in Section 4.1.1, significant measures have been developed to reduce the take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which would include fisheries for other species like scup and black sea bass) by requiring TEDs in trawl nets fished in the area of greatest turtle bycatch off the North Carolina and part of the Virginia coast from the North Carolina/South Carolina border to Cape Charles, VA. The TED requirements for the summer flounder trawl fishery do not at this time, however, require the use of larger TEDs that are used in the shrimp trawl fishery to exclude leatherbacks as well as large benthic immature and sexually mature loggerheads and green sea turtles.

4.4.4 Final Rule for Virginia Pound Nets

Existing information indicates that pound nets with large mesh and stringer leaders as used in the Chesapeake Bay incidentally take sea turtles. To address the high and increasing level of sea turtle strandings, NMFS published a Temporary Rule in June 2001 (66 FR 33489) that prohibited fishing with pound net leaders with a mesh size measuring 8 inches or greater (20.3 cm) and pound net leaders with stringers in mainstream waters of the Chesapeake Bay and its tributaries for a 30-day period beginning June 19, 2001. NMFS subsequently published an Interim Final Rule in 2002 (67 FR 41196, June 17, 2002) that further addressed the take of sea turtles in large-mesh pound net leaders and stringer leaders used in the Chesapeake Bay and its tributaries. Following new observations of sea turtle entanglements in pound net leaders in the spring of 2003, NMFS issued a temporary final rule (68 FR 41942, July 16, 2003) that restricted all pound net leaders throughout Virginia's waters of the Chesapeake Bay and a portion of its tributaries from July 16 - July 30, 2003. NMFS is continuing to address these entanglements, as well as impingements of turtles against leaders, and published a new final rule (69 FR 24997, May 5, 2004) for the use of pound net leaders in the Chesapeake Bay during the period May 6 - July 15 each year. The current rule prohibits the use of all pound net leaders, set with the inland end of the leader greater than 10 horizontal feet (3 meters) from the mean low water line, from May 6 - July 15 each year in the Virginia waters of the mainstream Chesapeake Bay, south of 37° 19' N and west of 76° 13' W, and all waters south of 37° 13' N to the Chesapeake Bay Bridge Tunnel at the mouth of the Chesapeake Bay, and the James and York Rivers downstream of the first bridge in each tributary. Outside of this area, the prohibition of leaders with greater than or equal to 12 inches (30.5 cm) stretched mesh and leaders with stringers, as established by the May 2004 final rule, applies from May 6 - July 15 each year.

Applicable to the 2010 fishing season and beyond, the state of Virginia required modified pound net leaders (as defined by Federal regulations) east of the Chesapeake Bay Bridge year round, and in offshore leaders in Regulated Area I (also as defined by Federal regulations) from May 6 to July 31. This is a 16 day extension of the Federal regulations in this area

4.4.5 Use of a Chain-Mat Modified Scallop Dredge in the Mid-Atlantic

In response to the observed capture of sea turtles in scallop dredge gear, including serious injuries and sea turtle mortality as a result of capture, NMFS proposed a modification to scallop dredge gear (70 FR 30660, May 27, 2005). The rule was finalized as proposed (71 FR 50361, August 25, 2006) and required federally permitted scallop vessels fishing with dredge gear to modify their gear by adding an arrangement of horizontal and vertical chains (hereafter referred to as a "chain mat") between the sweep and the cutting bar when fishing in Mid-Atlantic waters south of 41°9'N from the shoreline to the outer boundary of the EEZ during the period of May 1-November 30 each year. Subsequent rulemakings clarified the regulatory text regarding the chain-mat modified gear, added a transiting provision, and excluded the sweep from the requirement that the side of each opening in the chain mat be less than or equal to 14 inches (73 FR 18984, April 8, 2008; 74 FR 46930, September 14, 2009). The spatial and temporal extent of the requirements remained unchanged. The gear modification is expected to reduce the severity of some sea turtle interactions with scallop dredge gear. However, this modification is not expected to reduce the number of sea turtle interactions with scallop dredge gear

4.4.6 HMS Sea Turtle Protection Measures

As described in *Section 4.1.1* above, NMFS completed the most recent biological opinion on the FMP for the Atlantic HMS fisheries for swordfish, tuna, and shark on June 1, 2004, and concluded that the Atlantic HMS fisheries, particularly the pelagic longline fisheries, were likely to jeopardize the continued existence of leatherback sea turtles. An RPA was provided to avoid jeopardy to leatherback sea turtles as a result of operation of the HMS fisheries. Although the Opinion did not conclude jeopardy for loggerhead sea turtles, the RPA is also expected to benefit this species by reducing mortalities resulting from interactions with the gear.

4.4.7 Sea Turtle Handling and Resuscitation Techniques

NMFS also developed and published as a final rule in the *Federal Register* (66 FR 67495, December 31, 2001) sea turtle handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the final rule. These measures help to prevent mortality of hard-shelled turtles caught in fishing or scientific research gear.

4.4.8 Sea Turtle Entanglements and Rehabilitation

NMFS has also published a final rule (70 FR 42508, July 25, 2005) that allows any agent or employee of NMFS, the FWS, the U.S. Coast Guard, or any other Federal land or water management agency, or any agent or employee of a state agency responsible for fish and wildlife, when acting in the course of his or her official duties, to take endangered sea turtles encountered in the marine environment if such taking is necessary to aid a sick, injured, or entangled endangered sea turtle, or dispose of a dead endangered sea turtle, or salvage a dead endangered sea turtle that may be useful for scientific or educational purposes. NMFS already affords the same protection to sea turtles listed as threatened under the ESA (50 CFR 223.206(b)).

4.4.9 Internationally

The United States is pursuing sea turtle conservation measures through international, regional, and bilateral organizations such as ICATT, the Asia Pacific Fisheries Commission, and the FAO Committee on Fisheries (COFI). The United States intends to provide a summary report to FAO for distribution to its members on bycatch of sea turtles in U.S. longline fisheries and the research findings as well as recommendations to address the issue. At the 24th session of the COFI held in 2001, the U.S. distributed a concept paper for the international standardized collection of data, to exchange information on research, and to identify and consider solutions to reduce turtle bycatch. COFI agreed that the international technical meeting could be useful despite the lack of agreement on the specific scope of that meeting. The United States has held technical workshops to address sea turtle bycatch in longline fisheries as part of this agreement. The United States continues to explore other gear-specific international workshops which will assist and improve on the body of knowledge and will continue to explore other avenues in the future.

4.4.10 Sea Turtle Stranding and Salvage Network (STSSN)

There is an extensive network of STSSN participants along the Atlantic and Gulf of Mexico coasts which not only collects data on dead sea turtles, but also rescues and rehabilitates live stranded turtles. Data collected by the STSSN are used to monitor stranding levels and identify areas where unusual or elevated mortality is occurring. These data are also used to monitor incidence of disease, study toxicology and contaminants, and conduct genetic studies to determine population structure. All of the states that participate in the STSSN tag live turtles when encountered (either via the stranding network through incidental takes or in-water studies). Tagging studies help provide an understanding of sea turtle movements, longevity, and reproductive patterns, all of which contribute to our ability to reach recovery goals for the species.

4.4.11 Education and Outreach Activities

Education and outreach activities are considered one of the primary tools to reduce the threats to all protected species. For example, NMFS has been active in public outreach to educate fishermen regarding sea turtle handling and resuscitation techniques, as well as guidelines for recreational fishermen and boaters to avoid the likelihood of interactions with marine mammals. NMFS has conducted workshops with longline fishermen to discuss bycatch issues including protected species, and to educate them regarding handling, resuscitation techniques and release guidelines. NMFS intends to continue these outreach efforts in an attempt to reduce interactions with protected species, and to reduce the likelihood of injury to protected species when interactions do occur.

5.0 Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Sources of human-induced mortality, injury, and/or harassment of sea turtles in the action area that are reasonably certain to occur in the future include incidental takes in state-regulated fishing activities, vessel collisions, ingestion of plastic debris, and pollution. While the combination of these activities may affect populations of ESA-listed sea turtles, preventing or slowing a species' recovery, the magnitude of these effects is currently unknown.

State Water Fisheries - Fishing activities are considered one of the most significant causes of death and serious injury for sea turtles. The NRC (1990) report estimated that 550 to 5,500 sea turtles (juvenile and adult loggerheads and Kemp's ridleys) die each year from all other fishing activities besides shrimp fishing. Fishing gear in state waters, including bottom trawls, gillnets, trap/pot gear, and pound nets, take sea turtles each year. NMFS is working with state agencies to address the take of sea turtles in state water fisheries within the action area of this consultation where information exists to show that these fisheries take sea turtles. Action has been taken by some states to reduce or remove the likelihood of sea turtle takes in one or more gear types. However, given that state managed commercial and recreational fisheries along the Atlantic coast are reasonably certain to occur within the action area in the foreseeable future, additional takes of sea turtles in these fisheries are anticipated. There is insufficient information to quantify the number of sea turtle takes presently occurring as a result of state water fisheries as well as the number of sea turtles injured or killed as a result of such takes. While actions have been taken to reduce sea turtle takes in some state water fisheries, the overall effect of these actions on reducing the take of sea turtles in state water fisheries is unknown, and the future effects of state water fisheries on sea turtles cannot be quantified. Further information on past effects of state water fisheries on sea turtles is available in Section 4.1.2.

Vessel Interactions - NMFS STSSN data indicate that vessel interactions are responsible for a large number of sea turtle strandings within the action area each year. In the U.S. Atlantic from 1997-2005, 14.9% of all stranded loggerheads were documented as having sustained some type of propeller or collision injuries (NMFS and USFWS 2007a). The incidence of propeller wounds rose from approximately 10% in the late 1980s to a record high of 20.5% in 2004 (STSSN database). Such collisions are reasonably certain to continue into the future. Collisions with boats can stun, injure, or kill sea turtles, and many live-captured and stranded sea turtles have obvious propeller or collision marks (Dwyer *et al.* 2003). However, it is not always clear whether the collision occurred pre- or post-mortem. As a result, an estimate of the number of sea turtles that will likely be killed by vessels is not possible.

Pollution and Contaminants - Human activities causing pollution are reasonably certain to continue in the future, as are impacts from them on sea turtles in the action area. However, the level of impacts cannot be projected. Marine debris (*e.g.*, discarded fishing line or lines from boats) can entangle sea turtles in the water and drown them. Sea turtles commonly ingest plastic or mistake debris for food. Chemical contaminants may also have an effect on sea turtle reproduction and survival. Excessive turbidity due to coastal development and/or construction sites could influence sea turtle foraging ability. As mentioned previously, sea turtles are not very easily affected by changes in water quality or increased suspended sediments, but if these alterations make habitat less suitable for them and hinder their capability to forage, eventually they would leave or avoid these less desirable areas (Ruben and Morreale 1999). Noise pollution has been raised, primarily, as a concern for marine mammals but may be a concern for other marine organisms, including sea turtles. As described above, global climate change is likely to negatively affect sea turtles – affecting when females lay their eggs, the survival of the eggs, sex ratios of offspring, and the stability of the Gulf Stream. To the extent that air pollution, for example from the combustion of fossil fuels by vessels, contributes to global warming, then it is also expected to negatively affect sea turtles in the action area.

5.1 Summary and Synthesis of the Status of Species, Environmental Baseline, and Cumulative Effects sections

The *Status of the Species*, *Environmental Baseline*, and *Cumulative Effects* sections, taken together, establish a "baseline" against which the effects of the continued operation of the Atlantic MSB fishery within the constraints of the current MSB FMP are analyzed to determine whether the action is likely to jeopardize the continued existence of listed species in the action area. Past effects of the MSB fishery are included in this "baseline." To the extent available information allows, this baseline (which does not include the future effects of the MSB fishery) would be compared to the baseline plus the effects of the continued operation of the fishery under the FMP from now into the future. The difference in the two trajectories would be reviewed to determine whether the continued operation of the fishery within the constraints of the current MSB FMP is likely to jeopardize the continued existence of these species. This section synthesizes the *Status of the Species*, *Environmental Baseline*, and *Cumulative Effects* sections as best as possible given that some information on sea turtles is quantified, yet much remains qualitative or unknown.

Leatherback and Kemp's ridley sea turtles are endangered species, meaning that they are in danger of extinction throughout all or a significant portion of their ranges. The loggerhead sea turtle is a threatened species, meaning that it is likely to become an endangered species in the foreseeable future throughout all or a significant portion of its range. Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population which is listed as endangered. The result of past, present, and likely future human activities and natural events, some effects of which are positive, some negative, and some unknown, as discussed previously in the *Status of the Species*, *Environmental Baseline*, and *Cumulative Effects* sections taken together. Additional information is provided below.

Loggerhead sea turtles are listed as "threatened" under the ESA. Loggerhead nesting occurs on beaches of the Pacific, Indian, and Atlantic Oceans, and the Mediterranean Sea. Genetic analyses of maternally inherited mitochondrial DNA demonstrate the existence of separate, genetically distinct nesting groups between as well as within the ocean basins (TEWG 2000; Bowen and Karl 2007). The BRT has recently identified the following nine loggerhead DPSs distributed globally: (1) North Pacific Ocean, (2) South Pacific Ocean, (3) North Indian Ocean, (4) Southeast Indo-Pacific Ocean, (5) Southwest Indian Ocean, (6) Northwest Atlantic Ocean, (7) Northeast Atlantic Ocean, (8) Mediterranean Sea, and (9) South Atlantic Ocean. It should be noted, however, that DPSs can only be designated for regulatory uses through the formal ESA listing process.

It takes decades for loggerhead sea turtles to reach maturity. Once they have reached maturity, females typically lay multiple clutches of eggs within a season, but do not typically lay eggs every season (NMFS and USFWS 2008). There are many natural and anthropogenic factors affecting the survival of loggerheads prior to their reaching maturity as well as for those adults who have reached maturity. As described in sections 3.1 and 4.0, negative impacts causing death of various age classes occur both on land and in the water. In addition, given the distances traveled by loggerheads in the course of their development, actions to address the negative impacts require the work of multiple countries at both the national and international level (NMFS and USFWS 2007a). Many actions have been taken to address known negative impacts to loggerhead sea turtles. However, many remain unaddressed, have not been sufficiently addressed, or have been addressed in some manner but whose success cannot be quantified.

Sea turtle nesting data, in terms of the number of nests laid each year, is collected for loggerhead sea turtles for at least some nesting beaches within each of the ocean basins and the Mediterranean Sea. From this, the number of reproductively mature females utilizing those nesting beaches can be estimated based on the presumed remigration interval and the average number of nests laid by a female loggerhead sea turtle per season. These estimates provide a minimum count of the number of loggerhead sea turtles in any particular nesting group. The estimates do not account for adult females who nest on beaches with no or little survey coverage, and do not account for adult males or juveniles of either sex. The proportion of adult males to females from each nesting group, and the age structure of each loggerhead nesting group is currently unknown. For these reasons, there is a large uncertainty associated with using nest counts to estimate the total population size of a nesting group or trends in the number of nests laid as an indicator of the population (Meylan 1982; Ross 1996; Zurita *et al.* 2003; Hawkes *et al.* 2005; letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007; TEWG 2009).

Nevertheless, nest count data are a valuable source of information for each loggerhead nesting group and for loggerheads as a species since the number of nests laid reflects the reproductive output of the nesting group each year, and also provides insight on the contribution of each nesting group to the species. Based on a comparison of the available nesting data, the world's largest known loggerhead nesting group (in terms of estimated number of nesting females) occurs in Oman in the northern Indian Ocean, where an estimated 20,000-40,000 females nest each year (Baldwin *et al.* 2003). The world's second largest known loggerhead nesting group, the PFRU, occurs along the Southeast coast of the U.S. from the Florida/Georgia border through Pinellas County on Florida's West coast, where approximately 15,735 females nest per year (based on a mean of 64,513 nests laid per year from 1989-2007; NMFS and USFWS 2008). The world's third largest loggerhead nesting group also occurs in the U.S., from the Florida/Georgia border through southern Virginia. However, the approximate number of females nesting annually is 1,272 (based on a mean number of 5,215 nests laid per year from 1989-2008; NMFS and USFWS 2008), which is less than 1/10th the size of the PFRU. Thus, while loggerhead nesting occurs at multiple sites within multiple ocean basins and the Mediterranean Sea, the extent of nesting is disproportionate amongst the various sites and only two geographic areas, Oman and South Florida, account for the majority of nesting for the species worldwide.

Declines in loggerhead nesting have been noted at nesting beaches throughout the range of the species. The 2008 revised recovery plan by NMFS and FWS identified five unique recovery units of loggerheads in the Northwest Atlantic. Based on the most recent information, a decline in annual nest counts has been measured or suggested for three of the five recovery units. These include nesting for the PFRU – the second largest loggerhead nesting group in the world and the largest of all of the loggerhead nesting groups in the Atlantic (Meylan *et al.* 2006; NMFS and USFWS 2008). The final revised plan reviews and discusses the species' ecology, population status and trends, and identifies the many threats to loggerhead sea turtles in the Northwest Atlantic Ocean. It lays out a recovery strategy to address the threats, based on the best available science, and includes recovery goals and criteria. In addition, the plan identifies substantive actions needed to address the threats to the species and achieve recovery. In 2009, the TEWG indicated that it could not determine whether or not the decreasing annual numbers of nest amount the Northwest Atlantic loggerhead subpopulations were due to stochastic processes resulting in few nests, a decreasing average reproductive output of adult females, decreasing number of adult females, or a combination of these factors. The TEWG noted there were likely several factors contributing to the decline. These factors include incidental capture (in fisheries, power plant intakes, and dredging operations), lower adult female survival rates, increases in the proportion of first-time nesters, continued directed harvest, and increases in mortality due to disease. The current levels of hatchling output will no doubt result in depressed recruitment to subsequent life stages over the coming decades (TEWG 2009).

Although there is an increasing trend at some nesting beaches (Southwest Indian Ocean and South Atlantic Ocean), available information about anthropogenic threats to juveniles and adults in neritic and oceanic environments indicate possible unsustainable additional mortalities. NMFS recognizes that the available nest count data only provides information on the number of females currently nesting, and is not necessarily a reflection of the number of mature females available to nest or the number of immature females that will reach maturity and nest in the future. Also, the trend in the number of nests laid is not a reflection of the overall trend in any nesting group given that the proportion of adult males to females, and the age structure of each loggerhead nesting group is currently unknown. According to the threat matrix analysis in the BRT report, the potential for future decline is greatest for the North Indian Ocean, Northwest Atlantic Ocean, Northeast Atlantic Ocean, Mediterranean Sea, and South Atlantic Ocean DPSs (Conant *et al.* 2009).

Leatherback sea turtles are listed as "endangered" under the ESA. Leatherbacks are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, and Indian Oceans, the Caribbean Sea, Mediterranean Sea, and the Gulf of Mexico (Ernst and Barbour 1972). Leatherback nesting occurs on beaches of the Atlantic, Pacific, and Indian Oceans as well as in the Caribbean (NMFS and USFWS 2007b).

Like loggerheads, sexually mature female leatherbacks typically nest in non-successive years and lay multiple clutches in each of the years that nesting occurs. Leatherbacks face a multitude of threats that can cause death prior to and after reaching maturity. Some activities resulting in leatherback mortality have been addressed. However, many others remain to be addressed. Given their range and distribution, international efforts are needed to address all known threats to leatherback sea turtle survival (NMFS and USFWS 2007b).

There are some population estimates for leatherback sea turtles although there appears to be considerable uncertainty in the numbers. In 1980, the global population of adult leatherback females was estimated to be approximately 115,000 (Pritchard 1982). By 1995, this global population of adult females was estimated to be 34,500 (Spotila *et al.* 1996). However, the most recent population size estimate for the North Atlantic alone is 34,000-94,000 adult leatherbacks (TEWG 2007; NMFS and USFWS 2007b).

Leatherback nesting in the eastern Atlantic (*i.e.,* off Africa) and in the Caribbean appears to be stable, but there is conflicting information for some sites and it is certain that some nesting groups (*e.g.*, St. John and St. Thomas, U.S. Virgin Islands) have been extirpated (NMFS and USFWS 1995). Data collected for some nesting beaches in the western Atlantic, including leatherback nesting beaches in the U.S., clearly indicate increasing numbers of nests (NMFS SEFSC 2001; NMFS and USFWS 2007b). However, declines in nesting have been noted for beaches in the western Caribbean (NMFS and USFWS 2007b). The largest leatherback rookery in the western Atlantic remains along the northern coast of South America in French Guiana and Suriname. More than half the present world leatherback population is estimated to nest on the beaches in and close to the Marowijne River Estuary in Suriname and French Guiana (Hilterman and Goverse 2004). The long-term trend for the Suriname and French Guiana nesting group seems to show an increase (Hilterman and Goverse 2004). In 2001, the number of nests for Suriname and French Guiana combined was 60,000, one of the highest numbers observed for this region in 35 years (Hilterman and Goverse 2004). Studies by Girondot *et al.* (2007) also suggest that the trend for the Suriname - French Guiana nesting population over the last 36 years is stable or slightly increasing.

Increased nesting by leatherbacks in the Atlantic is not expected to affect leatherback abundance in the Pacific where the abundance of leatherback sea turtles on nesting beaches has declined dramatically over the past 10 to 20 years (NMFS and USFWS 2007b). Although genetic analyses suggest little difference between Atlantic and Pacific leatherbacks (Bowen and Karl 2007), it is generally recognized that there is little to no genetic exchange between these turtles.

In addition, Atlantic and Pacific leatherbacks are impacted by different activities (NMFS and USFWS 1992, 1998a). However, the ESA-listing of leatherbacks as a single species means that the effects of a proposed action must, ultimately, be considered at the species level for section 7 consultations. NMFS recognizes that the nest count data available for leatherbacks in the Atlantic clearly indicates increased nesting at many sites, and that the activities affecting declines in nesting by leatherbacks in the Pacific are not the same as those activities affecting leatherbacks in the Atlantic. However, NMFS also recognizes that the nest count data, including data for leatherbacks in the Atlantic, only provides information on the number of females currently nesting, and is not necessarily a reflection of the number of mature females in the Atlantic that are available to nest or the number of immature females that will reach maturity and nest in the future. Also, the number of nests laid is not a reflection of the overall leatherback population given that the proportion of adult males to females and the age structure of the population(s) are unknown.

Kemp's Ridley sea turtles are listed as a single species classified as "endangered" under the ESA. Kemp's ridleys occur in the Atlantic Ocean and Gulf of Mexico. The only major nesting site for Kemp's ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; USFWS and NMFS 1992; NMFS and USFWS 2007c). Approximately 60% of its nesting occurs here with a limited amount of scattered nesting to the north and south of the primary nesting beach (NMFS and USFWS 2007c).

Age to maturity for Kemp's ridley sea turtles occurs earlier than for either loggerhead or leatherback sea turtles. However, maturation may still take 10-17 years (NMFS and USFWS 2007c). As is the case with the other sea turtle species, adult female Kemp's ridleys typically lay multiple nests in a nesting season but do not typically nest every nesting season (TEWG 2000; NMFS and USFWS 2007c). Although actions have been taken to protect the nesting beach habitat and to address activities known to negatively impact Kemp's ridley sea turtles, Kemp's ridleys continue to be impacted by anthropogenic activities (see sections 3.1.3 and 4.1).

Nest count data provides the best available information on the number of adult females nesting each year. As is the case with the other sea turtles species discussed above, nest count data must be interpreted with caution given that these estimates provide a minimum count of the number of nesting Kemp's ridley sea turtles. In addition, the estimates do not account for adult males or juveniles of either sex. Without information on the proportion of adult males to females, and the age structure of the Kemp's ridley population, nest counts cannot be used to estimate the total population size (Meylan 1982; Ross 1996; Zurita *et al.* 2003; Hawkes *et al.* 2005; letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007). Nevertheless, the nesting data does provide valuable information on the extent of Kemp's ridley nesting and the trend in the number of nests laid. Estimates of the adult female nesting population reached a low of approximately 250-300 in 1985 (USFWS and NMFS 1992; TEWG 2000). From 1985 to 1999, the number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3% per year (TEWG 2000). Current estimates suggest an adult female population of 7,000-8,000 Kemp's ridleys (NMFS and USFWS 2007c).

The most recent review of the Kemp's ridley as a species suggests that it is in the early stages of recovery (NMFS and USFWS 2007b). Nest count data indicate increased nesting and increased numbers of nesting females in the population. NMFS also takes into account a number of recent conservation actions including the protection of females, nests, and hatchlings on nesting beaches since the 1960s and the enhancement of survival in marine habitats through the implementation of TEDs in the early 1990s and a decrease in the amount of shrimping off the coast of Tamaulipas and in the Gulf of Mexico in general (NMFS and USFWS 2007b).

Green sea turtles are listed as both threatened and endangered under the ESA. Breeding colony populations in Florida and on the Pacific coast of Mexico are considered endangered while all others are considered threatened. Due to the inability to distinguish between these populations away from the nesting beach, for this Opinion, green sea turtles are considered endangered wherever they occur in U.S. waters. Green sea turtles are distributed circumglobally and can be found in the Pacific, Indian, and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991; Seminoff 2004; NMFS and USFWS 2007d).

Green sea turtles appear to have the latest age to maturity of all of the sea turtles with age at maturity occurring after 2-5 decades (NMFS and USFWS 2007d). As is the case with all of the other sea turtle species mentioned here, mature green sea turtles typically nest more than once in a nesting season but do not nest every nesting season. As is also the case with the other sea turtle species, green sea turtles face numerous threats on land and in the water that affect the survival of all age classes.

A review of 32 Index Sites distributed globally revealed a 48% to 67% decline in the number of mature females nesting annually over the last three generations (Seminoff 2004). For example, in the eastern Pacific, the main nesting sites for the green sea turtle are located in Michoacan, Mexico, and in the Galapagos Islands, Ecuador, where the number of nesting females exceeds 1,000 females per year at each site (NMFS and USFWS 2007d). Historically, however, greater than 20,000 females per year are believed to have nested in Michoacan alone (Cliffton *et al.* 1982; NMFS and USFWS 2007d). However, the decline is not consistent across all green sea turtle nesting areas. Increases in the number of nests counted and, presumably, the numbers of mature females laying nests were recorded for several areas (Seminoff 2004; NMFS and USFWS 2007d). Of the 32 index sites reviewed by Seminoff (2004), the trend in nesting was described as: increasing for 10 sites, decreasing for 19 sites, and stable (no change) for 3 sites. Of the 46 green sea turtle nesting sites reviewed for the 5-year status review, the trend in nesting was described as increasing for 12 sites, decreasing for 4 sites, stable for 10 sites, and unknown for 20 sites (NMFS and USFWS 2007d). The greatest abundance of green sea turtle nesting in the western Atlantic occurs on beaches in Tortuguero, Costa Rica (NMFS and USFWS 2007d). Nesting in the area has increased considerably since the 1970s and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007d). One of the largest nesting sites for green sea turtles worldwide is still believed to be on the beaches of Oman in the Indian Ocean (Hirth 1997; Ferreira *et al.* 2003; NMFS and USFWS 2007d). However, nesting data for this area has not been published since the 1980s and updated nest numbers are needed (NMFS and USFWS 2007d).

The results of genetic analyses show that green sea turtles in the Atlantic do not contribute to green sea turtle nesting elsewhere in the species' range (Bowen and Karl 2007). Therefore, increased nesting by green sea turtles in the Atlantic is not expected to affect green sea turtle abundance in other ocean basins in which the species occurs. However, the ESA-listing of green sea turtles as a species across ocean basins means that the effects of a proposed action must, ultimately, be considered at the species level for section 7 consultations. NMFS recognizes that the nest count data available for green sea turtles in the Atlantic clearly indicates increased nesting at many sites. However, NMFS also recognizes that the nest count data, including data for green sea turtles in the Atlantic, only provides information on the number of females currently nesting, and is not necessarily a reflection of the number of mature females available to nest or the number of immature females that will reach maturity and nest in the future. Given the late age to maturity for green sea turtles (20 to 50 years) (Balazs 1982; Frazer and Ehrhart 1985; Seminoff 2004), caution is urged regarding the nesting trend for any of the nesting groups since no area has a dataset spanning a full green sea turtle generation (NMFS and USFWS 2007d).

6.0 EFFECTS OF THE PROPOSED ACTION

This section of the opinion assesses the direct and indirect effects of the proposed action on threatened and endangered species, together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02).

Several protected species impact assessment documents prepared by NMFS or the Council have a direct relationship and bearing on this analysis. An assessment of impacts of the MSB fishery on endangered and threatened species of sea turtles, is presented in the MSB EIS prepared by the Council (NEFMC 1999) and additional discussion of entanglement in gear types used in the MSB fishery can be found in the EIS's for Amendment 9 and 10 (NEFMC 2009).

Listed sea turtles species may be directly affected by fishing activities authorized under the MSB FMP through incidental take or indirectly by effects on prey resources. Incidental take could include injury or mortality resulting from entanglement, entrapment, disturbance, or collisions between fishing vessels and listed species.

As described in Section 1.0, NMFS has determined that ESA-listed loggerhead, leatherback, Kemp's ridley, and green sea turtles will be affected by the continued operation of the MSB fishery, within the constraints of the current MSB FMP, as a result of capture and entanglement in trawl gear associated with this fishery. Trawl gear (single and paired trawl and bottom otter trawl) is the dominant gear promulgated in the MSB fishery and have increased their participation in the fishery in recent years. As previously stated, other gears including hand line, weirs, gillnets and purse seines may also be fished but constitute a very minor overall percentage (4% in total) of gear fished in the fishery. Based on past observer reports of the MSB fishery or of other fisheries using similar gear types in areas where sea turtles also occur, trawl gears as used in the MSB fishery are expected to continue to pose a risk of entanglement and/or capture for ESA-listed sea turtles leading to injuries and possibly death.

Sea turtles are known to be killed and injured as a result of being struck by vessels on the water. Fishing vessels operating as a result of the continued authorization of the MSB fishery under the

MSB FMP are unlikely to strike loggerhead, leatherback, Kemp's ridley, or green sea turtles in the action area given that: (a) MSB fishing vessels operate at a relatively slow operating speed; (b) a portion of the fishing occurs in areas in which sea turtles are less likely (*e.g.*, Georges Bank) or not likely (*e.g.*, northern Gulf of Maine) to be present in comparison to Mid-Atlantic waters, (c) a portion of the fishing occurs at times when sea turtles are not likely to be present (the winter period in Mid-Atlantic waters and the late-fall through mid-spring in New England waters) (NMFS 2003; 2004a; 2004b), (d) sea turtles spend part of their time at depths out of range of a vessel collision with boats used in the MSB fishery, and (e) the proposed action is not expected to increase the amount of vessel traffic in areas where sea turtles occur.

The continued authorization of the MSB fishery will not reduce the availability of prey for loggerhead, leatherback, Kemp's ridley or green sea turtles. Trawl gear catch horseshoe crabs, other crabs species, whelks and fish as bycatch along with the targeted catch of MSB (NEFMC 2003; NMFS 2007b). None of these are typical prey species of leatherback sea turtles or of neritic juvenile or adult green sea turtles (the probable age classes anticipated to be captured in the MSB fishery) (Rebel 1974; Mortimer 1982; Bjorndal 1985; USFWS and NMFS 1992; Bjorndal 1997). Therefore, continued authorization of the MSB fishery will not affect the availability of prey for leatherback and green sea turtles in the action area.

NMFS's assessment of the effects of the MSB fishing gear-sea turtle interactions on loggerhead, leatherback, Kemp's ridley, and green sea turtles is provided below in order for NMFS to make a final determination as to whether the proposed action is likely to jeopardize the continued existence of these species.

6.1 Spatial and Temporal Overlap

As previously mentioned, the potential for direct interaction between a fishery and listed species is limited by the degree of spatial and temporal overlap, while indirect effects could occur over a broader range of areas and times. A detailed analysis of overlap between the present MSB fishery and listed species is not available at this time. However, some qualitative statements can be made based on current knowledge on the distribution of mackerel, squid and butterfish resource and listed species. The MSB resource is widely distributed in the action area and overlaps the distribution of all listed sea turtle species considered in this consultation to a certain extent. Sea turtles are most likely to interact with the fishery during the months of June through October because during this period the fishery and gear co-occur and overlap to a greater extent.

The MSB fishery as described previously (section 2.1 - 2.4), uses mobile gear types including bottom otter trawls, mid-water trawls, paired and single trawls, and on a much smaller and more defined scale, purse seine, weir and gillnet gear.

The bottom otter trawl and the mid-water single and paired trawl fisheries operate in slightly different locals depending on the time of year. Atlantic mackerel and squid fisheries operate throughout the Gulf of Maine, on Georges Bank, and in Southern New England and can also be found in Mid-Atlantic waters. Mackerel are fished in greater numbers during winter, usually until the end of April between ME and NC, but mainly along the continental shelf, South East of Long Island, NY and East of Delmarva. The three directed fisheries (Atlantic mackerel and the two squid species) are continental shelf fisheries and are commercially fished geographically at varying times of the year. One common example is the *Lolligo* fishery with its peak in spring and fall, is prosecuted mainly with bottom trawl gear, with the early winter fishery occurring on/or near the continental shelf, while the spring and fall fishery occurs predominantly in the nearshore and coastal areas and in these locals may use traps and weirs. Southern areas are winter fisheries while the northern areas are summer fisheries. Just as in the herring fishery, different types of trawl gear (bottom, mid-water and paired trawl) target Atlantic mackerel and squid species.

In order to assess the effects of the continued authorization of the MSB fishery on ESA-listed sea turtles, NMFS is using information collected by observers as well as information on the description and operation of MSB fishing gear, life history information for sea turtles, and the effects of fishing gear entanglements on sea turtles that has been published in a number of documents. These documents include sea turtle status reviews and biological reports (NMFS and USFWS 1995; 2007a; 2007b; 2007c; 2007d; TEWG 1998; 2000), recovery plans (NMFS and USFWS 1991a and b; NMFS and USFWS 1992; USFWS and NMFS 1992, NMFS 2009), the stock assessment report for loggerhead and leatherback sea turtles (NMFS SEFSC 2001), estimates of sea turtle takes in the Mid –Atlantic bottom trawl fishery (Murray 2008), and numerous other sources of information from the published literature as cited below.

6.2 Information Available for the Assessment

Sea turtles incidentally captured in fishing gear must be reported to NMFS on Vessel Trip Reports that are required for the Federal MSB fishery and other federal fisheries. However, to date, there have been no reports of turtle interactions on VTR forms submitted by MSB fishing vessels. The absence of reports does not mean that interactions were not or are not occurring. Compliance with the Federal requirement for federally permitted fisherman to report sea turtle interactions on their VTRs is very low for all fisheries where VTRs are required. As described further below, NMFS trained observers reported 9 interactions between sea turtles and MSB fishing gears during the last eleven years, a period between 1999 (the last Opinion) and the end of 2009.

There have been relatively few reported entanglements of sea turtles in MSB fishing gear (Murray 2008). In general, sea turtle interactions with fishing gear occur below the surface. The only visible evidence of these interactions are observations of turtles captured within the gear upon hauling of the gear to the surface. In the absence of VTR reporting, the only means by which NMFS has acquired information on sea turtles captured in or retained upon gear used in the commercial MSB fishery is by reporting from NMFS trained observers assigned to fishing vessels on a trip-by-trip basis. Information on the number, condition, and species of sea turtles captured in or retained upon MSB trawl gear is collected by NMFS trained observers and submitted to the NEFSC, Fisheries Sampling Branch (FSB). The FSB observers use many parameters to fully explain and characterize individual fisheries. In reporting observed sea turtle take with MSB fishing gear, NMFS will utilize "the top species landed (kept) by weight" during a fishing trip as its defining parameter to characterize and provide a general descriptive account of sea turtle interactions with MSB gear

6.2.1 Description of the Gear

Multiple gear types are used in the MSB fishery including bottom otter trawl, mid-water trawl, single and paired trawl and, those with minimal participation include hand lines, rod and reel, traps/pots, and gillnet (NMFS 2007). Bottom otter trawl and mid-water trawl represent the dominant gear type as indicated on permits for the 2007 MSB fishing year (NMFS 2008). Other gear types which may be used in the MSB fishery include pelagic longline/hook-and line/handline, pot/trap, dredge, pound net, gillnet, and bandit gear. As previously stated in Section 2 *Summary*, for the other gears allowed in the fishery, the effort is relatively small, sea turtle interactions are expected to be rare and unlikely.

The characteristics of trawl gear vary based on the species targeted. An overview of bottom otter trawl gear and the components of the gear, in general, is provided in the Supplemental Environmental Impact Statement for Amendment 9 and 10 to the MSB FMP (NEFMC 2008 and 2009). Briefly, bottom otter trawls are comprised of a net to catch the target species (NEFMC 2003). Doors attached to two cables are used to keep the mouth of the net open while deployed. A sweep runs along the bottom of the net mouth (NEFMC 2003). Depending on the bottom type and species targeted, the sweep may be configured with chains, "cookies" (small rubber disks), or larger rubber disks (rock-hoppers or roller gear) that help to prevent the net from snagging on bottom that contains rocks or other structures (NREFHSC 2002; NEFMC 2003; NEFSC pers. comm.). Turtle exclude devices (TEDs) are not currently required to be used in trawl gear targeting MSB.

Compared to other Atlantic trawl fisheries, the commercial MSB fishery is a high volume fishery in total landings. As mentioned earlier, the directed MSB fishery is conducted primarily in federal waters, with the exception of *Loligo* fishery. During summer and fall, this fishery can occur predominantly nearshore, otherwise the MSB fisheries for the most part occur on or near the continental shelf. In general, when referencing squid fisheries, Mid-Atlantic landings predominate over North and South Atlantic regions. While, Atlantic mackerel fishing, predominately occurs during winter from January–April, from Maine to N.C. Therefore, spatially, the greatest interactions with these fisheries and ESA-listed sea turtles would be expected to involve entanglement, capture, or hooking of sea turtles, primarily in the Mid-Atlantic area. The time of year that would be expected to result in the greatest number of interactions would be from spring through fall in the Mid-Atlantic. However, some interactions could occur in other regions of the U.S. Atlantic as landings occur in every month.

Sea turtle interactions with trawl gear used in the MSB fishery can take the form of entanglements of the head, limbs, or carapace or captures of the entire animal. The use of TEDs in trawls and the length of the tows influence the level of harm to sea turtles. For all the gear types, it is often difficult for an observer to tell if an animal released alive has been injured to the point of influencing its future survival potential. Consequently, since most data on interaction with gear cannot be refined to further detail with respect to level of effect as described above, the term "incidental take" is sometimes used in this discussion to refer to these different types of potential interactions with MSB gear.

Mid-Atlantic and southern New England waters are known to be foraging areas for sea turtles in the spring through fall, while South Atlantic waters are used for foraging year round (Keinath *et al.* 1987; Thompson 1988; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998; Braun-McNeill and Epperly 2004; James *et al.* 2005a; Morreale and Standora 2005). Loggerhead and Kemp's ridley sea turtles are known to feed on benthic organisms such as crabs, whelks, and other invertebrates including bivalves (Keinath *et al.* 1987; Lutcavage and Musick 1985; Dodd 1988; Burke *et al.* 1993, 1994; Morreale and Standora 2005; Seney and Musick 2005). The MSB fishery is known to capture crabs, whelks, and other organisms as bycatch (MAFMC and ASMFC 1998; NMFS 2007d). Therefore, if loggerhead and Kemp's ridley sea turtles are foraging in areas where bottom otter trawling occurs, the sea turtles are likely to be spending some of their time on or very near the bottom where they would be at risk of being entrained in the trawl gear.

6.2.2 Description of Incidental Takes of Sea Turtles

Sea turtles incidentally taken in fishing gear must be reported to NMFS on Vessel Trip Reports (VTRs) that are required for the MSB fishery and other federal fisheries. Compliance with the Federal requirement for federally permitted fishermen to report sea turtle interactions on their VTRs is very low. Without reliable VTR reporting of sea turtle takes, NMFS is using information collected through the Northeast Fisheries Observer Program (NEFOP), which collects, processes and manages data and biological samples obtained by trained observers during a subset of commercial fishing trips throughout the New England and the Mid-Atlantic regions.

The discussion of sea turtle takes in Atlantic mackerel, squid and butterfish gear that follows will focus on trawl gear. Past observed takes of ESA-listed species in trawl gear were reviewed in the April 28, 1999, Opinion for the Atlantic mackerel, squid and butterfish fishery. Updated information is provided herein. It is difficult to ascertain gear types responsible for entanglements when only portions of the gear or injuries resulting from entanglements are observed. Additionally important to note is that the reported takes are likely a fraction of the total takes, which are unknown.

The majority of interactions between sea turtles and bottom trawl fisheries of the Atlantic coast have occurred south of the New England region since the distribution of sea turtles correlates with warmer water temperatures, resulting in greater densities of sea turtles south of New England. The spatial distribution of sea turtles in southern New England and the Mid-Atlantic is coincident with several fisheries.
Loggerhead sea turtles represent the majority of sea turtles species observed incidentally taken in trawl and gillnet gear in the action area. Observers reported 66 loggerhead sea turtle interactions with bottom otter trawl gear from 1994-2004 (Murray 2008). Of the 66 documented loggerhead interactions, 38 (57%) were alive and uninjured, and 28 (43%) were dead, injured, resuscitated, or of unknown condition. Documented trawl gear takes of loggerheads after the time periods analyzed in Murray (2008, 2009a) are presented in Table 4.

Table 4. Documented incidental captures of loggerhead sea turtles (excluding moderately and severely decomposed turtles) in bottom otter trawl (scallop, fish, and twin[3]) from 2005-2009 and gillnet gear from 2007-2009 along with the most landed commercial species (by weight) per trip. Gillnet gear includes anchored sink gillnets and drift sink gillnets. Source: NEFSC FSB database.

	Bottom Otter Trawl										Gillnet			
Most Landed Species (by weight)	Summer Flounder	Monkfish	Little Skate	Atlantic Croaker	Squid	Smooth Dogfish	Winter Flounder	Horseshoe Crab	Sea Scallop	Unassigned	Sandbar Shark	Southern Flounder	Atlantic Croaker	Monkfish
Loggerhead takes	13	1	1	56	5	1	1	3	11	1	1	4	1	1
Years	2005-2009										2007-2009			

The estimates of loggerhead sea turtle bycatch in bottom otter trawl gear published in Murray (2008) represent the best available information and analysis for loggerhead bycatch in mid and North Atlantic commercial fisheries. Such estimates are not available for leatherback, Kemp's ridley, and green sea turtle takes. Therefore, observer data for these species represents the best available information.

The NEFOP has documented the most landed (by weight) kept species when an incidental take occurs (among many other variables), and that information has been used to provide a look at which commercial species most correspond to the incidental takes for leatherback, Kemp's ridley, and green sea turtles (Table 5).

Table 5. Documented incidental captures of leatherback, Kemp's ridley, green, and unidentified sea turtles (excluding moderately and severely decomposed turtles) in bottom otter trawl (scallop and fish) and gillnet gear from 2000-2009 along with the most landed commercial species (by weight) per trip. Gillnet gear includes anchored sink gillnets and drift sink gillnets. Source: NEFSC FSB database.

	Bottom Otter Trawl						Gillnet								
Most Landed Species (by weight)	Longfin Squid	Summer Flounder	Atlantic Croaker	Silver Hake	Pollock	Sea Scallop	Spanish Mackerel	Summer Flounder	Southern Flounder	Smooth Dogfish	Spiny Dogfish	Bluefish	Winter Skate	King Mackerel	Monkfish
Leatherback	1	1	0	1	0	0	1	0	0	0	0	1	1	0	0
Kemp's	0	1	1	0	0	0	1	0	54	1	1	0	0	0	0
Green	1	0	0	0	0	0	1	2	125	0	0	0	0	0	0
Unidentified	0	0	3	0	1	1	0	0	0	1	0	0	0	3	5

3 Twin trawl gear only accounted for one loggerhead capture with summer flounder as the most abundant landed species.

4 Twelve (12) green and five (5) Kemp's ridley sea turtles were observed incidentally taken in 2009 by a state fishery targeting southern flounder with sink gillnet gear in Pamlico Sound. Although, Pamlico Sound is located at the southern most point of the action area, these takes were documented by the NEFOP, and will be considered in this Opinion.

5Ibid

While it may be informative to look at the number of leatherback, Kemp's ridley and green sea turtles observed to have been taken on bottom otter trawl when the majority of the landings were Atlantic mackerel, squid and butterfish, using this number as the estimated take would be an underestimate in two ways. First, sea turtle takes could have occurred on trips where Atlantic mackerel, squid and butterfish was part of the catch, but constituted less than the majority of the catch. Second, these takes are only observed takes and we are not currently able to use them to generate an estimate of total takes. In order to compensate for this underestimate, for the purposes of estimating incidental take of leatherback, Kemp's ridley and green sea turtles in fishing gear authorized under the Atlantic Mackerel, Squid and Butterfish FMP we are going to look at takes by gear type as illustrated in the table below (Table 6).

Table 6. Documented incidental captures of leatherback, Kemp's ridley, green, and unidentified sea turtles (excluding moderately and severely decomposed turtles) in bottom otter trawl (scallop and fish) and gillnet gear from 2000-2009. Gillnet gear includes anchored sink gillnets and drift sink gillnets. Source: NEFSC Fisheries Sampling Branch (FSB) database.

	Documented # of incidental takes in BOT gear	**Documented # of incidental takes/year in BOT gear**	**Documented # of incidental takes in gillnet gear**	**Documented # of incidental takes/year in gillnet gear**
Leatherback sea turtle	3	0.3	3	0.3
Kemp's ridley sea turtle	2	0.2	8	0.8
Green sea turtle	1	0.1	15	1.5
Unidentified sea turtle	5	0.5	9	0.9

The NEFSC conducts trawl surveys to monitor marine resources and their habitats. During spring and fall bottom otter trawl surveys conducted by the NEFSC from 1963-2008, a total of 71 loggerhead sea turtles were observed captured. The NEFSC trawl survey tows are approximately 30 minutes in duration. In contrast, commercial fisheries typically tow bottom otter trawl gear in excess of one hour (Murray 2006).

Observations of takes in bottom otter trawls indicate that fisheries using this gear type are capable of incidentally taking sea turtles and that some of these interactions are lethal. Bottom trawl effort is less common in the summer and fall months when sea turtles are more likely to exist within deep mid-Atlantic and New England waters. Turtles have also been observed to dive to the bottom and hunker down when alarmed by loud noise or gear (Memo to the File, L. Lankshear, December 4, 2007), which could place them in the path of bottom gear such as a trawl. Loggerhead and Kemp's ridley sea turtles are known to feed on benthic organisms such as crabs, whelks, and other invertebrates including bivalves (Keinath *et al.* 1987; Lutcavage and

Musick 1985; Dodd 1988; Burke *et al.* 1993; Burke *et al.* 1994; Morreale and Standora 2005; Seney and Musick 2005). NMFS anticipates that green sea turtles will interact with trawl gear in the same manner as loggerhead sea turtles *(i.e.,* both on the bottom and in the water column). Therefore, if loggerhead, Kemp's ridley, and green sea turtles are foraging in areas where Atlantic mackerel, squid and butterfish fishery operates, the turtles would be at risk.

Tagging studies have shown that leatherbacks, occurring seasonally for foraging in western North Atlantic continental shelf waters where the Atlantic mackerel, squid and butterfish fishery operates, stay within the water column rather than near the bottom (James *et al.* 2005a). Given the largely pelagic life history of leatherback sea turtles (Rebel 1974; CeTAP 1982; NMFS and USFWS 1992), and the dive-depth information on leatherback use of western North Atlantic continental shelf waters (James *et al.* 2005a; 2005b), it is unlikely that a leatherback would occur on the bottom in the action area.

6.2.3 Description of the Sea Turtles Caught in MSB Gear

Many changes have occurred in the MSB fishery since the early 1970's. The predominant gear type in the fishery has changed over the years and is now predominantly single or paired trawl gear. Observed sea turtle interactions in the fishery have remained low relative to overall fishing effort (Murray 2006). Prior to the 1999 Opinion, foreign fishing vessels took part in the MSB fishery and were common place. Today, foreign fishers have little or no participation in the fishery.

Of the 6 sea turtle interactions discussed in the 1999 Opinion (going back to the 1980's), only one occurred due to the domestic fleet (a non-lethal take of loggerhead in 1990). The remaining observed interactions (total of five) occurred in two specific years, 1982, 2 takes (1 lethal loggerhead and 1 non-lethal leatherback) and in 1986, 3 non-lethal takes occurred (2 loggerhead and 1 leatherback). All of these fishery sea turtle interactions occurred within the foreign squid fishery fleet, with only one non-lethal interaction of a loggerhead occurring pre 1990 in the domestic mackerel trawl fishery.

Given all the above considerations, the primary species likely to be adversely affected by the MSB fishery would be loggerhead sea turtles, as they are the most abundant species occurring in U.S. Atlantic waters. Sea sampling and observer data indicate that fewer interactions occur between fisheries that capture MSB and leatherback, Kemp's ridley, and green sea turtles. The primary area of impact of the directed commercial fishery for MSB on sea turtles is likely bottom otter trawls in waters of the Mid-Atlantic from Virginia through New York, from late spring through fall (peak *Loligo* abundance July – October). In New England, interactions with trawl gear may occur in summer through early fall (peak squid abundance August – September), although given the level of effort, the probability of interactions is much lower than in the Mid-Atlantic.

As previously stated, the observer database uses many parameters to fully explain and characterize individual fisheries. NERO PR will utilize the top fish species landed (or kept) on a trip as its defining parameter to characterize when sea turtle interactions with the MSB fishery occur. Since the completion of the last BO (in 1999), there have been 9 observed sea turtle interactions in the MSB fishery, over an 11 year period, (1999 to 2009). In 2002, 5 sea turtles were captured on one single fishing trip. On haul 5 of the trip, 3 sea turtles were caught, 1 sea turtle was captured on haul 10 while 1 sea turtle was captured on haul 14. A freshly dead loggerhead was taken during haul 14. Four of the five sea turtles captured on this trip were severely decomposed and the species could not be identified. Three of these, were wrapped up in a gillnet that was bound around the headrope of the trawl (on haul 5). The observer recorded that a sea turtle captured on haul 10, the next day, was probably a recapture from the previous day, as the severely decomposed unknown sea turtle was similar in size and in decomposition state as the previous day. These 4 unknown sea turtles were not brought onboard as the crew cut the gillnet off the headrope as it was being hauled in. These 4 unknown sea turtles captures were all in an advanced state of decomposition, indicating that these animals were entangled for a period of time, and were possibly ensnared post fishing in ghost gear. The first three sea turtles were caught on 10/8 (haul 5), the fourth on 10/9 (haul 10) and the fifth on 10/10 (haul 14), all in statistical area 616. These severely decomposed unknown sea turtle interactions were not recorded as takes by the MSB fishery. While the fresh dead loggerhead taken on 10/10 was assessed against the MSB fishery. All of these interactions occurred in the Atlantic longfin squid (*Loligo*) fishery and all takes occurred with bottom otter trawl gear.

Outside of these captures in 2002, the only other observed sea turtle interactions (post consultation, 1999) have occurred in 2001, 2004, 2008 and 2009. All of these observed interactions since 1999, have occurred as part of the squid fishery (total of 9). During 2001 the first and only interaction with a leatherback was observed and recorded during the month of October. In 2004 there was one observed interaction with a loggerhead, the next observed take occurred in 2008 (I loggerhead), while five takes have been observed in 2009, 4 loggerhead and 1 green sea turtle.

The majority of sea turtles captured in the MSB fishery are loggerhead sea turtles. Since 2000, of the 9 turtles observed interacting with the MSB fishery, 7 were loggerhead, 1 was a leatherback, and 1 was a green. Additional training of observers since early 2000s has greatly reduced the number of sea turtles that are not identified to species by observers. However, unknowns are still likely to be reported because the observer does not always have the opportunity to identify the sea turtle to species (*e.g.*, when a sea turtle is shaken from or swims out of the gear before it is hauled on deck). The sea turtle hauled up by a trawl hung up on a gillnet in October 2002 was unable to be identified to species by the observer prior to its being shaken from the net. This unidentified hard-shelled sea turtle could have been a loggerhead, Kemp's ridley, or green sea turtle. Since the 1999 Opinion, loggerhead sea turtles have been the sea turtle most likely to occur in the action area for this consultation and have been incidentally taken in fishing gear that is capable of catching MSB (NEFSC FSB database).

In summary, their have been 9 observed sea turtle takes in the MSB fishery during the past 11 years (using top species landed). All sea turtle takes have occurred in bottom otter trawl gear participating in the squid fishery. Loggerhead sea turtles are more likely to interact with MSB trawl gear but green, Kemps ridley and leatherback interaction may also occur. All sea turtles were released alive, except the 2002 take, when a gillnet was hauled up as part of the catch when the loggerhead turtle entangled was fresh dead.

6.2.4 *Information on Factors Affecting Sea Turtle Capture in MSB Fishing Gear*

As described in sections 3.1.1 – 3.1.4, the occurrence of loggerhead, leatherback, Kemp's ridley, and green sea turtles in New England, Mid-Atlantic, and south Atlantic waters is primarily temperature dependent (Thompson 1984; Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a; Morreale and Standora 2005). In general, sea turtles move up the U.S. Atlantic coast from southern wintering areas as water temperatures warm in the spring (Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a; Morreale and Standora 2005). The trend is reversed in the fall as water temperatures cool. By December, sea turtles have passed Cape Hatteras, returning to more southern waters for the winter (Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a; Morreale and Standora 2005). Recreational anglers have reported sightings of sea turtles in waters defined as inshore waters (bays, inlets, rivers, or sounds; Braun-McNeill and Epperly 2004) as far north as New York as early as March-April, but in relatively low numbers (Braun-McNeill and Epperly 2004). Greater numbers of loggerheads, Kemp's ridleys, and greens are found in inshore, nearshore, and offshore waters of North Carolina and Virginia from May through November and in inshore, nearshore, and offshore waters of New York from June through October (Keinath *et al.* 1987; Morreale and Standora 1993; Braun-McNeill and Epperly 2004). The hard-shelled sea turtles appear to be temperature limited to water no further north than Cape Cod. Leatherback sea turtles have a similar seasonal distribution but have a more extensive range in the Gulf of Maine compared to the hard-shelled species (Shoop and Kenney 1992; Mitchell *et al.* 2003; STSSN database).

Extensive survey effort of the continental shelf from Cape Hatteras to Nova Scotia, Canada in the 1980s (CeTAP 1982) observed loggerheads at the surface in waters from the beach to waters with bottom depths of up to 4,481 m. However, they were generally found in waters where bottom depths ranged from 22-49 m deep (the median value was 36.6 m; Shoop and Kenney 1992). Leatherbacks were sighted at the surface in waters with bottom depths ranging from 1-4,151 m deep (Shoop and Kenney 1992). However, 84.4% of leatherback sightings occurred in waters where the bottom depth was less than 180 m (Shoop and Kenney 1992), whereas 84.5% of loggerhead sightings occurred in waters where the bottom depth was less than 80 m (Shoop and Kenney 1992). Neither species was commonly found in waters over Georges Bank, regardless of season (Shoop and Kenney 1992). The CeTAP study did not include Kemp's ridley and green sea turtle sightings, given the difficulty of sighting these smaller sea turtle species (CeTAP 1982).

Given the seasonal distribution of sea turtles and the times and areas when the MSB fishery operates, all four species of sea turtles are likely to overlap with operation of the fishery year round in south Atlantic waters and from May through November in Mid-Atlantic waters and waters of southern Georges Bank. Based on the best, currently available information, sea turtle interactions with MSB gear are likely at times when and in areas where sea turtle distribution overlaps with operation of the fishery.

The mackerel part of the fishery does not generally operate in bays, inlets, rivers, or sounds, and generally takes place during winter and further off shore on/near the continental shelf (between Jan to April), with much less occurring outside this period. Sea turtle distribution would not be expected to overlap with the distribution of Atlantic mackerel fishing gear until May in nearshore and offshore waters off of North Carolina and Virginia, and until June in nearshore and offshore waters off of New York. Squid fishing on the other hand, takes place during spring, summer and fall in SNE and Mid-Atlantic near shore waters. Given the seasonal distribution of sea turtles and the times and areas when the MSB fishery operates, all four species of sea turtles are likely to overlap with operation of the fishery from May through November in Mid-Atlantic waters, and waters of southern Georges Bank.

The NEFSC has attempted to identify a variable or set of variables for predicting sea turtle bycatch in the bottom otter trawl component of the MSB fishery during times and in areas where sea turtle distribution and operation of the bottom trawl fishery overlap (Murray 2008). Based on analysis of observer data, environmental variables (depth and sea surface temperature) have been shown to correlate with sea turtle bycatch (Murray 2008). Based on Murray's analysis, the likelihood of interacting with a turtle depends on the time and area in which fishing takes place rather than the fish species being targeted. Murray states that "increased observer coverage allocated over temporal and spatial strata may provide more information about the likelihood of turtle bycatch" in trawls targeting fish species.

Fishery observer records for the MSB fishery show lower coverage prior to 2004 but coverage increased between 2004 and 2008 (Waring et al. 2008 and 2009). In general, all fishing gear types regulated under the MSB fishery have had increased observer coverage over the past five years, since 2004. Observer trips analyzed for the MSB fishery (as defined in the FMP), are those trips that land > 50% of total landings by weight of fish species per trip. For example, the *Loligo* fishery has had improved estimated observer coverage and the data output recorded has increased for observed fishing trips (2000-2003; 0.65% observed coverage verses 2004-2007: 3.5% observed coverage) (Waring et al. 2009). The majority of these fishery observations occurred in the predominant MSB fishing gear type, primarily, the bottom otter trawl fishery. Another observed calibration often used is observed fishing days in the fishery. This parameter, within the *Loligo* fishery has also experienced a large increase in total trip days observed (days). These increased from 543 observed days (1999-2003) to 1,494 days (2004-2008) (Waring et al. 2007 and 2008). This substantial improvement adds a tripling of observed days over the last five years.

In addition, the highest overall observer coverage ever recorded and intensity of sea sampling for all gear types in any given year occurred for the mackerel fishery. The largest increase occurred in the paired trawl fishery (2003-2007, average 7.4 % observer coverage). Each of the individual mackerel fishing gears, bottom, midwater and paired trawl gears recorded higher observer coverage (Waring et al. 2009). These observer trips prove to be the overall highest coverage ever recorded in the MSB fishery. These new and higher fishing observer coverage rates allow for a greater degree of flexibility, and leads to an increase in comfort level and understanding, when analyzing recent gear usage data in the fishery for all possible interactions with ESA-listed sea turtle species and the data gathered will be included in future fishery modeling exercises.

The model developed in Murray's 2008 paper and analysis is an explanatory model that estimates total bycatch of loggerhead turtles in Mid-Atlantic bottom otter trawl gear during 2000-2004. Before this model can be used as a true predictive model to estimate the annual bycatch of loggerhead turtles beyond 2004, several factors should be considered, such as annual trends in fishing effort and location, possible changes in turtle abundance and distribution, and observer coverage rates/patterns. Predicted bycatch rates were derived from all observed bottom trawl hauls in the Mid-Atlantic and pooled over 5 years. This analysis assumes that bycatch rates follow a constant trend across the 5-year period. If annual trends in sea turtle bycatch rates are not constant, then applying long-term average bycatch rates to estimate total bycatch in future years could be biased depending on changes in fishing effort, turtle abundance and distribution, or other environmental anomalies.

NMFS has also considered other factors that might affect the likelihood that a sea turtle will be captured in or otherwise taken by (meaning physical contact without capture in) MSB fishing gear. These other factors include the behaviour of sea turtles in the presence of fishing gear, as well as the effect of certain oceanographic features and fishery practices on sea turtle distribution and abundance. For example, video footage recorded by NMFS, Southeast Fisheries Science Center (SEFSC), Pascagoula Laboratory indicated that loggerhead sea turtles will keep swimming in front of an advancing shrimp trawl, rather than deviating to the side, until the turtles become fatigued and are caught by the trawl or the trawl is hauled up (NMFS 2002). MSB fishing practices may also influence sea turtle distribution and abundance in areas where vessels are operating. Bottom otter trawl gear stirs up and catches turtle prey species. The stirring up of prey items as well as the discarding of turtle prey may attract sea turtles to areas where MSB fishing gear is operating, thus increasing the likelihood of sea turtle interactions with the gear. Nevertheless, while all of the above are reasonable circumstances that might be affecting the likelihood of sea turtle interactions with MSB trawl gear, there is currently no information to support any of these.

Based on the best, currently available scientific information, sea turtle interactions with MSB gear are likely at times when and in areas where sea turtle distribution overlaps with operation of the fishery. Observer data has provided data by which to estimate loggerhead bycatch in the MSB fishery for the year in which the data was collected. However, no predictive variable or set of variables has yet been identified that would enable NMFS to predict the exact number of future sea turtle takes in the fishery (Murray 2006 and 2008).

6.3 Anticipated Effects of the Proposed Action

NMFS has identified that the proposed action is likely to adversely affect ESA-listed sea turtles when the turtles come into physical contact with MSB fishing gear. Such contact has occurred in the fishery and resulted in injuries, including very severe injuries causing death, to sea turtles. No other direct effects to sea turtles are expected as a result of the proposed action. No indirect effects to sea turtles are expected as a result of the proposed action. In this section of the Opinion, NMFS will determine, given the currently available information, the anticipated number of sea turtles that will be affected by the continued authorization of the MSB fishery defining such effects by species, and the estimated mortality of sea turtles that are caught by species in the MSB fishery.

6.3.1 Anticipated number of sea turtle interactions with MSB gear

The extent of loggerhead bycatch has been estimated (2000-2004) for some years based on data collected by observers. Based on data collected by observers for the reported sea turtle captures in or retention in MSB trawl gear, the NEFSC estimated loggerhead bycatch in the MSB trawl fishery between 2000-2004 (Murray 2008) was 62 animals annually. Murray outlined her model approach and determined that the estimated take of 62 sea turtles annually in the MSB trawl fishery represented the best available information on the anticipated annual take of loggerhead sea turtles in the MSB fishery in any given year.

Given the level of low interaction in the fishery, it has not been possible to extrapolate an estimated number for leatherback, green and Kemps ridley sea turtle takes that may occur in the trawl component of the fishery under current available data. For these reasons, NMFS is basing its estimate of takes in the Atlantic mackerel, squid and butterfish trawl fisheries on the maximum level of take observed between years 2000-2009. This approach may overestimate take in the fishery, however, it may also underestimate the level of take given that observer coverage in the fishery has been low (prior to 2004) and is focused primarily on the northern portion of the action area (albeit the area believed to have less constant sea turtle concentrations in relation to trawl fishing effort).

There are no science-based estimates for the capture of leatherback, Kemp's ridley or green sea turtles in MSB trawl fishing gear. As stated earlier in Section 6.2.2, NEFOP observers have documented interactions with 108 loggerheads, three leatherbacks, two Kemp's ridleys, one green, and five unidentified sea turtles in Mid-Atlantic bottom otter trawl gear from January 2000 through December 2008 (NEFSC FSB database).

Thus, Murray's estimate of loggerhead sea turtle takes in the MSB fishery (annual total of 62) provides the best available information for determining the anticipated take of loggerhead sea turtles in the fishery since no predictive variable or set of variables has been found. A new updated estimate for loggerhead sea turtle takes in mid-Atlantic trawl gear is being developed, using more recent observer data and is expected late 2010. It is anticipated that the FMP/target species breakdown will be conducted in a manner similar to that done for the current gillnet paper (Murray 2009a). For the purposes of this Opinion, NMFS will use the estimate generated in the Murray 2006 and 2008 papers, as that represents the best available data.

There are no estimates for the capture of leatherback sea turtles and there has been only one confirmed take of a leatherback sea turtle in MSB gear since the last completed Opinion (1999). Tagging studies have shown that leatherbacks occur seasonally for foraging in western North Atlantic continental shelf waters where the MSB fishery operates, and stay within the water column rather than near the bottom (James *et al.* 2005a). Given the largely pelagic life history of leatherback sea turtles (Rebel 1974; CeTAP 1982; NMFS and USFWS 1992), and the more recent dive-depth information on leatherback use of western North Atlantic continental shelf waters (James *et al.* 2005a; 2005b), it is unlikely that a leatherback would occur on the bottom in the action area. Therefore, leatherback sea turtles are not likely to be struck by or captured in MSB trawl gear when the gear was being towed along the bottom.

Since only one leatherback has been observed in the MSB fishery in the period 2000-2004, and none have occurred since the 2001 take, it is likely that interactions with this species are relatively rare events. Based on observations of leatherback turtle taken in other trawl and in the MSB gear, NMFS believes some sea turtle interactions with MSB gear occur within the water column. Given the large size of the trawls and the presence of leatherback sea turtles in areas where the MSB fishery occurs, NMFS does believe that leatherback sea turtles can be captured in trawl gear when the gear is in the water column (NMFS 2006b). With respect to other mobile gear operating in the area where the MSB fishery operates, there have been only two observed takes (capture in the gear) of leatherback sea turtles over the period 1995-2007. This suggests that capture of leatherback sea turtles in any mobile gear operating within the action area, including MSB gear, would be a rare event. As stated previously, in Section 6.2.2, Table 5 and 6 the number of documented leatherback incidental captures in bottom trawl gear has been 0.3 annually. Since the take of a partial turtle is not possible, NMFS anticipates the potential annual take of one leatherback sea turtle with bottom otter trawl gear.

However, given the generally low level of past observer coverage (pre 2004) in the MSB fishery as well as other mobile gear (trawl) fisheries in the action area, it is likely that some interactions with leatherback sea turtles have occurred but were not observed or reported. A prediction of one leatherback take results from using an average of the number of takes for the 2000-2008 time period since a "part" of a turtle cannot be taken. Additionally, because of the average annual take of 0.5 unidentified turtles in bottom otter trawl gear, another sea turtle (either a leatherback, Kemp's ridley, or green) is forecasted to be taken in the Atlantic mackerel, squid and butterfish fishery annually. Thus, the continued operation the bottom otter trawl gear component of the Atlantic mackerel, squid and butterfish fishery is anticipated to result in the annual non-lethal or lethal take of up to two (2) leatherback sea turtles. Therefore, NMFS believes that the take of two leatherback sea turtle in mobile gear in the action area for this Opinion provides the best available information on the anticipated annual take of leatherback sea turtles in MSB gear.

Similarly, there are no estimates for the capture of Kemp's ridley or green sea turtles in MSB gear. NMFS has recorded only one capture of a green sea turtle and has no observed interaction with Kemp's ridley sea turtles in MSB trawl gear. Trawl gear in other fisheries have been known to take both green sea turtles and Kemp's ridley sea turtles in the area where the MSB fishery is prosecuted. Given effort in the fishery as a whole, and the seasonal overlap in distribution of this species with operation of MSB gear, Kemp's ridley and green sea turtles are likely to be captured in MSB gear.

As summarized in Table 5 and 6, Section 6.2.2 the number of documented Kemp's ridley incidental captures in bottom otter trawl gear has been 0.2 annually. Since the take of a partial turtle is not possible, NMFS anticipates the potential annual take of one Kemp's ridley sea turtle with bottom otter trawl gear. Additionally, because of the average annual take of 0.5 unidentified turtles in bottom otter trawl gear, another sea turtle (either a leatherback, Kemp's ridley, or green) is forecasted to be taken in the Atlantic mackerel, squid and butterfish fishery annually. Thus, the continued operation the bottom otter trawl gear component of the Atlantic mackerel, squid and butterfish fishery is anticipated to result in the annual non-lethal or lethal take of up to two (2) Kemp's ridley sea turtles

The low number of observed green sea turtle captures in bottom otter trawl gear used in the Atlantic mackerel, squid and butterfish fisheries in the action area suggests that capture of green turtles within the area would be a rare event. However, given the generally low percentage of trips observed in the Atlantic mackerel, squid and butterfish fisheries (pre 2004) as well as other mobile gear (trawl) fisheries in the action area, and the range of this species overlaps with part of the Atlantic mackerel, squid and butterfish fsheries, it is possible that some interactions with green sea turtles have occurred but were not observed or reported.

As summarized in Table 5 and 6, Section 6.2.2, the number of documented green sea turtles incidental captures in bottom otter trawl gear has been 0.1 annually. Since the take of a partial turtle is not possible, NMFS anticipates the potential annual take of one green sea turtle with bottom otter trawl gear. Additionally, because of the average annual take of 0.5 unidentified turtles in bottom otter trawl gear, another sea turtle (either a leatherback, Kemp's ridley, or green) is forecasted to be taken in the Atlantic mackerel, squid and butterfish fisheries annually. Thus, the continued operation the bottom otter trawl gear component of the Atlantic mackerel, squid and butterfish fishery is anticipated to result in the annual non-lethal or lethal take of up to two (2) green sea turtles.

As described earlier in this Opinion, several reports by Murray (2008, 2009a) have been published that analyze fishery observer data and VTR data from fishermen in order to estimate the takes of loggerhead sea turtles in bottom otter trawl gear and gillnet gear in the mid-Atlantic. These reports estimate the average number of loggerhead sea turtles taken in each gear type (bottom trawl and sink gillnet, respectively) across all fisheries (i.e., FMPs), and they each also divide the takes by FMP or targeted species/species group. These documents represent the most accurate predictor for sea turtle takes in the MSB fishery and other Northeast fisheries that use these gear types.

It is important to note that while both reports divide the takes by FMP/targeted species, the two reports use different methodologies. The trawl estimate (Murray 2008) assigned trips (and associated takes) to a single FMP/targeted species based on the most significant species landed (by weight) for that trip. The gillnet estimate (Murray 2009a) assigned trips (and associated takes) to multiple FMPs/targeted species based on the distribution of landings for that trip. For example, trips in a certain time and area using gillnets or trawls were estimated to have a certain take rate of loggerhead sea turtles (based on the observed takes). In the trawl estimate, each trip in that time/area was assigned to a single FMP/targeted species. So if a trip landed 60 percent summer flounder, 20 percent spiny dogfish, and 20 percent weakfish, the trip and its associated takes (calculated using the take rate), were assigned to summer flounder and summer flounder only. In the gillnet estimate, the trip and its associated takes (calculated using the take rate), were assigned to summer flounder, spiny dogfish, and weakfish, in a 60:20:20 ratio. The latter method, used in the gillnet estimate, is meant to reflect the multispecies nature of many of the fisheries in the Northeast Region.

Another difference between the two estimates is that the trawl estimate does not provide a confidence interval around the point estimate for each target species – it just provides an average annual take level over the 2000-2004 time period. The gillnet estimate does provide a 95 percent confidence interval around the annual point estimate for each target species. Due to this difference, the takes assumed and analyzed for this Opinion are the point estimates for trawl gear. This difference is also carried through into the Incidental Take Statement, and influences how the takes in the fishery will be monitored.

The NEFSC is in the process of conducting an updated estimate of loggerhead sea turtle takes in mid-Atlantic trawl gear, using more recent observer and fisheries data. It is anticipated that the FMP/target species breakdown will be conducted in a manner similar to that done for the current gillnet paper (Murray 2009a). The updated trawl estimate is expected to be completed in late 2010.

6.3.2 Age classes of sea turtles anticipated to interact with the MSB fishery

Loggerhead sea turtles. NMFS SEFSC (2001) reviewed size at stage data for Atlantic loggerheads. Depending on the dataset used, the cutoff between pelagic immature and benthic immature loggerhead sea turtles was 42-49 cm (16.4-19.11 inches) straight carapace length (SCL) and the cutoff between benthic immature and sexually mature loggerhead sea turtles was described as 83-90 cm (32.4-35.1 inches) SCL. NMFS expects that both benthic immature and sexually mature loggerhead sea turtles will be captured in MSB fishing gear as a result of the continued authorization of the MSB fishery.

Leatherback sea turtles. NMFS believes that leatherback sea turtles may be captured in MSB fishing gear given the presence of leatherback sea turtles in areas where the fishery occurs. Stranding and sighting records suggest that both adult and immature leatherback sea turtles occur within the action area where the MSB fishery operates (NMFS and USFWS 1992; NMFS SEFSC 2001). Tracking of tagged leatherbacks also demonstrate the movement of sexually mature leatherbacks over U.S. continental shelf waters (James *et al.* 2005a, 2005b). Therefore, either immature or sexually mature leatherback sea turtles could be captured in MSB gear since both age classes occur in areas where the fishery operates.

Kemp's ridley sea turtles. The post-hatchling stage for Kemp's ridley sea turtles was defined by the TEWG as Kemp's ridleys of 5-20 cm (2-8 inches) SCL while turtles 20-60 cm (8-23 inches) SCL were considered to be benthic immature (TEWG 2000). The latter stage is described as sea turtles that have recruited to coastal benthic habitat. Mid-Atlantic and coastal New England waters (as far north as approximately Cape Cod) are known to be developmental foraging habitat for immature Kemp's ridley sea turtles, while adults have been documented from waters and nesting beaches along the South Atlantic coast of the U.S. (Musick and Limpus 1997; TEWG 2000; Morreale and Standora 2005). Given the life history of the species, NMFS expects that either immature or sexually mature Kemp's ridley sea turtles could be captured in MSB gear as a result of the continued authorization of the fishery.

Green sea turtles. Hirth (1997) defined a juvenile green sea turtle as a post-hatchling up to 40 cm (16 inches) SCL. A subadult was defined as green sea turtles from 41 cm (16 in) through the onset of sexual maturity (Hirth 1997). Sexual maturity was defined as green sea turtles greater than 70-100 cm (27-39 inches) SCL (Hirth 1997). Like Kemp's ridley sea turtles, Mid-Atlantic waters are recognized as developmental habitat for green sea turtles after they enter the benthic environment (Musick and Limpus 1997; Morreale and Standora 2005). NMFS expects that benthic immature and/or sexually mature green sea turtles could be captured in MSB fishing gear as a result of the continued authorization of the MSB fishery.

6.3.3 *Estimated mortality of sea turtles that interact with MSB fishing gear*

Capture, entanglement, and/or hooking of sea turtles in MSB fishing gear likely results in a higher level of sea turtle mortality than is evident based on the number of sea turtles returned to the water alive. Injuries suffered by sea turtles captured in MSB gear fall into two main categories: (1) Submergence injuries characterized by an absence or obvious reduction in breathing and consciousness with no other apparent injury, and (2) contact injuries characterized by entanglement or hooking of flippers and/or other body parts in the gear. The following information is provided as an assessment of the extent of these types of injuries likely to occur in the future for sea turtles affected by the continued operation of the MSB fishery.

Sea turtles forcibly submerged in any type of restrictive gear eventually suffer fatal consequences from prolonged anoxia and/or seawater infiltration of the lung (Lutcavage *et al.* 1997). A study examining the relationship between tow time and sea turtle mortality in the shrimp trawl fishery showed that mortality was strongly dependent on trawling duration, with the proportion of dead or comatose turtles rising from 0% for the first 50 minutes of capture to 70% after 90 minutes of capture (Henwood and Stuntz 1987). However, metabolic changes that can impair a sea turtle's ability to function can occur within minutes of a forced submergence. While most voluntary dives appear to be aerobic, showing little if any increases in blood lactate and only minor changes in acid-base status, the story is quite different in forcibly submerged turtles, where oxygen stores are rapidly consumed, anaerobic glycolysis is activated, and acid-base balance is disturbed, sometimes to lethal levels (Lutcavage and Lutz 1997). Forced submergence of Kemp's ridley sea turtles in shrimp trawls resulted in an acid-base imbalance after just a few minutes (times that were within the normal dive times for the species) (Stabenau *et al.* 1991). Conversely, recovery times for acid-base levels to return to normal may be prolonged. Henwood and Stuntz (1987) found that it took as long as 20 hours for the acid-base levels of loggerhead sea turtles to return to normal after capture in shrimp trawls for less than 30 minutes. This effect is expected to be worse for sea turtles that are recaptured before metabolic levels have returned to normal.

Following the recommendations of the NRC to reexamine the association between tow times and sea turtle deaths, the data set used by Henwood and Stuntz (1987) was updated and re-analyzed (Epperly *et al.* 2002; Sasso and Epperly 2006). Seasonal differences in the likelihood of mortality for sea turtles caught in trawl gear were apparent. For example, the observed mortality exceeded 1% after 10 minutes of towing in the winter (defined in Sasso and Epperly (2006) as the months of December-February), while the observed mortality did not exceed 1% until after 50 minutes in the summer (defined as March-November; Sasso and Epperly 2006). In general, tows of short duration (<10 minutes) in either season have little effect on the likelihood of mortality for sea turtles caught in the trawl gear and would likely achieve a negligible mortality rate (defined by the NRC as <1%). Intermediate tow times (10-200 minutes in summer and 10-150 minutes in winter) result in a rapid escalation of mortality, and eventually reach a plateau of high mortality, but will not equal 100%, as a turtle caught within the last hour of a long tow will likely survive (Epperly *et al.* 2002; Sasso and Epperly 2006). However, in both seasons, a rapid escalation in the mortality rate did not occur until after 50 minutes (Sasso and Epperly 2006) as had been found by Henwood and Stuntz (1987). Although the data used in the reanalysis were specific to bottom otter trawl gear in the U.S. south Atlantic and Gulf of Mexico shrimp fisheries, the authors considered the findings to be applicable to the impacts of forced submergence in general (Sasso and Epperly 2006).

Tows by bottom otter trawl vessels in the MSB fishery are usually around one to two hours in duration, which should help to reduce the risk of death from forced submergence for sea turtles caught in MSB trawl gear, but does not eliminate the risk. However, it is impossible to know at what point during the tow that a turtle was taken. Observer reports indicate that for the time period of 2004-2008 there was one observed take of a loggerhead sea turtle in the MSB bottom trawl fishery, and it was released alive (NEFSC Observer Database). In Murray's 2008 report, she analyzed all loggerhead take in the mid-Atlantic bottom trawl fisheries. Of the 66 documented loggerhead sea turtle interactions, approximately 57% survived, while 43% were considered unknown or dead. Assuming, these results are reflective of survival in the MSB fishery, and applying this ratio to overall loggerhead turtle take in the fishery, 57% of the loggerhead sea turtles that interacted with the fishery would survive (35 loggerhead survive from 62 sea turtle takes).

6.4 Summary of anticipated incidental takes of sea turtles in the MSB fishery

Based on the discussions above, including analysis of observer data, Murray's report on estimated bycatch analysis for loggerhead in bottom trawls and comparison to similar fisheries, the commercial MSB fishery is likely to have its greatest effect on sea turtles in the Mid-Atlantic area from spring through fall. Though the fishery regulates four individual species, all four species are fished primarily with bottom trawl or single and paired mid-water trawls. Consequently, all incidental takes are likely to occur during the use of bottom or mid-water trawls (single or paired).

Based on the best available information regarding sea turtle takes in gear utilized in the MSB fishery, NMFS anticipates the take of up to 62 loggerhead sea turtles annually as a result of the continued operation of the MSB fishery. Loggerheads originating from nesting beaches of each of the five recognized nesting groups in the western North Atlantic may be captured in gear used in the MSB fishery. Loggerhead turtles captured by MSB gear may be expected to include benthic immature and sexually mature turtles. It is thought that the MSB sea turtle take might be similar in make up as those captured in the scallop fishery as the fishery is conducted in similar geographic areas. Thus, loggerhead sea turtles originating from nesting beaches of each of the five recognized nesting groups in the western North Atlantic are expected to be captured in gear used in the MSB fishery. The majority of the turtles captured originate from nesting beaches of the south Florida nesting group (Haas *et al.* in review).

As described above, NMFS has no new information on estimates of leatherback, Kemp's ridley, or green sea turtle takes in the MSB fishery. NMFS expects two (2) sea turtle captures, in the MSB fishery to be leatherback (lethal/or nonlethal), two (2) Kemp's ridley (lethal/or non lethal), and two (2) green (lethal/or nonlethal) sea turtles.

Over the past eight years (prior to 2009), there has been no observed capture of leatherback sea turtles in MSB trawl gear. Prior to this, a leatherback sea turtle was observed captured in bottom otter trawl gear used in the *Loligo* squid fishery in 2001, while a second leatherback sea turtle was observed captured in bottom otter trawl gear used in the summer flounder fishery in 2007. Both of these takes occurred within the action area of this Opinion. The very low number of observed leatherback captures in trawl gear used in multiple trawl fisheries in the action area suggests that capture of leatherback sea turtles in any mobile gear operating within the action area would be a rare event. However, given the generally low level of observer coverage in the MSB trawl fishery (prior to 2004) as well as other mobile gear (trawl) fisheries in the action area, it is likely that some interactions with leatherback sea turtles have occurred but were not observed or reported. Given effort in the fishery as a whole, and the seasonal overlap in distribution of this species with operation of MSB trawl gear, leatherback sea turtles are likely to be captured in MSB trawl gear. A prediction of two takes results from using an average of the number of takes for the 2000-2009 time period since a "part" of a turtle cannot be taken.

Similarly, there have been no observed takes of Kemp's ridley or green sea turtles in the MSB fishery. NMFS believes, however, that takes of Kemp's ridley and green sea turtles may occur given that the distribution of these species overlaps with operation of the MSB trawl fishery. With respect to other mobile gear operating in the area, specifically dredge gear, there have been only two observed takes of a Kemp's ridley sea turtles and one observed take of a green sea turtle during the period 1996-2007. As described above, this suggests that the capture of Kemp's ridley and green sea turtles in any mobile gear operating within the action area, including MSB trawl gear, would be a rare event. However, given the low level of observer coverage in the MSB trawl fishery (prior to 2004) as well as other mobile gear fisheries in the action area it is likely that some interactions have occurred but were not observed or reported. Therefore, based on the number of takes from 2000-2009, the anecdotal evidence and by inference from other fisheries, the number of the takes per year is, two Kemp's ridley sea turtles and two takes of green sea turtles in MSB trawl gear.

From the analysis in this Opinion, NMFS now believe that approximately 43% (27) of the loggerhead sea turtles (62 in total) captured in the MSB fishery will die or otherwise be seriously injured as a result of the capture. For leatherback, Kemp's ridley, and green sea turtles, it is assumed that the take assessed (two of each species) will be lethal/or non lethal.

The death, capture, or injury of these small numbers of sea turtles would not appreciably diminish the viability of sea turtle populations in the action area. Further, NMFS does not believe it would be reasonable to expect the death, capture, harm, or harassment of these numbers of sea turtles to appreciably reduce the likelihood of survival and recovery of these species in the wild.

7.0 Integration and Synthesis of Effects

The *Status of Affected Species*, *Environmental Baseline*, and *Cumulative Effects* sections of this Opinion discuss the natural and human-related phenomena that caused listed species to become threatened or endangered and may continue to place sea turtle species at high risk of extinction. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). The present section of this Opinion applies that definition by examining the effects of the continued authorization of the MSB fishery under the FMP (described in Section 6.2) in the context of information presented in the status of the species, environmental baseline, and cumulative effects sections to determine: (a) if those effects due to the fishery would be expected to reduce the reproduction, numbers, or distribution of threatened or endangered species, and (b) if any reduction in the reproduction, numbers, or distribution of listed species causes an appreciable reduction in the likelihood of those species surviving and recovering in the wild.

7.1 Integration and Synthesis of Effects on Sea Turtles

This Opinion has identified in Section 6 (*Effects of the Proposed Action*) that the proposed action, the continued authorization of the fishery under the MSB FMP, will adversely affect loggerhead, leatherback, Kemp's ridley, and green sea turtles as a result of interactions (including entanglement, capture, or hooking) with MSB fishing gear. The towing of bottom trawl, mid-water and paired trawl on benthic habitats as a result of the continued authorization of the fishery will have an insignificant effect on sea turtles. The operation of MSB fishing vessels on the water will also have discountable effects on sea turtles. The following discussion in Sections 7.1.1 through 7.1.4 provide NMFS's determinations of whether there is a reasonable expectation that loggerhead, leatherback, Kemp's ridley, and green sea turtles will experience reductions in reproduction, numbers, or distribution in response to these effects, and whether any reductions in the reproduction, numbers, or distribution of these species can be expected to appreciably reduce the likelihood of these species surviving and recovering in the wild.

7.1.1 Loggerhead Sea Turtle

As described above, the use of bottom otter trawl gear, for the proposed activity is expected to adversely affect loggerhead sea turtles as a result of capture within these gears. This Opinion has identified in Section 6.2.2 that the proposed activity, continued operation of the fishery under the Atlantic Mackerel, Squid and Butterfish FMP, will directly affect loggerhead sea turtles by capturing up to 62 loggerhead sea turtles in bottom otter trawl gear. As a result of being captured in the fishing gear, up to 27 of the 62 loggerhead sea turtles captured annually are expected to die or sustain serious injuries leading to death or failure to reproduce. The vessel usage and towing of trawl gear on benthic habitat, and the temporary removal of loggerhead prey from the environment (which may be returned to the water alive or dead) as a result of the fishing activities will have an insignificant effect on loggerhead sea turtles, as discussed in

Section 4.1.1. No other direct or indirect effects to loggerhead sea turtles are expected as a result of the proposed action.

The second revision of the recovery plan for loggerhead sea turtles in the Northwest Atlantic includes several objective and measurable recovery criteria which, when met, would result in a determination that the species be removed from the List of Endangered and Threatened Wildlife (NMFS and USFWS 2008). Recovery criteria can be viewed as targets, or values, by which progress toward achievement of recovery objectives can be measured. Recovery criteria may include such things as population numbers and sizes, management or elimination of threats by specific mechanisms, and specific habitat conditions. As a result, there is a need to frame recovery criteria in terms of both population parameters (Demographic Recovery Criteria) and the five listing factors (Listing Factor Recovery Criteria). The nesting beach Demographic Recovery Criteria are specific to recovery units. The remaining criteria cannot be delineated by recovery unit because individuals in the recovery units mix in the marine environment; therefore, these criteria are applicable to all recovery units. Recovery criteria must be met for all recovery units (NMFS and USFWS 2008). The Demographic Criteria for nests and nesting females were based on a time frame of one generation for U.S. loggerheads - defined as 50 years - selected as a biologically meaningful time period over which to assess recovery. To be considered for delisting, each recovery unit will have recovered to a viable level and each recovery unit will have increased for at least one generation. The rate of increase used for each recovery unit was dependent upon the level of vulnerability of each recovery unit. The minimum statistical level of detection (based on annual variability in nest counts over a generation time of 50 years) of 1% per year was used for the PFRU, the least vulnerable recovery unit. A higher rate of increase of 3% per year was used for the NGMRU and DTRU, the most vulnerable recovery units. A rate of increase of 2% per year was used for the NRU, a moderately vulnerable recovery unit (NMFS and USFWS 2008).

A fundamental problem with restricting population trend analyses to nesting beach surveys is that they are unlikely to reflect changes in the entire population. This is because of the long time lag to maturity and the relatively small proportion of females that are reproducing for the first time on a nesting beach, at least in populations with high adult survival rates. A decrease in oceanic juvenile or neritic juvenile survival rates may be masked by the natural variability in nesting female numbers and the slow response of adult abundance to changes in recruitment to the adult population (Chaloupka and Limpus 2001). In light of this, two additional Demographic Criteria were developed to ensure a more representative measure of population status was achieved. The first of these additional Demographic Criteria assesses trends in abundance on foraging grounds, and the other assesses age-specific trends in strandings relative to age-specific trends in abundance on foraging grounds. For the foraging grounds, a network of index in-water sites, both oceanic and neritic, distributed across the foraging range must be established and monitored to measure abundance. Recovery can be achieved if there is statistical confidence (95%) that a composite estimate of relative abundance from these sites is increasing for at least one generation. For trends in strandings relative to in-water abundance, recovery can be achieved if stranding trends are not increasing at a rate greater than the trends in in-water relative abundance for similar age classes for at least one generation. These latter two demographic criteria are not specific to recovery units because progeny from the various recovery units mix on the foraging grounds. As a result, in-water trends were not developed for the individual recovery units (NMFS and USFWS 2008).

The lethal take of up to 27 loggerhead sea turtles from the Atlantic every year will reduce the number of loggerhead sea turtles as compared to the number that would have been present in the absence of the proposed action (assuming all other variables remained the same). Assuming half of the 27 are females, the loss of female loggerhead sea turtles as a result of the proposed action is expected to reduce the reproduction of loggerheads in the Atlantic compared to the reproductive output of Atlantic loggerheads in the absence of the proposed action. These losses are relevant to the Demographic Recovery Criteria for nests and nesting females. Nesting data demonstrate recent declines in the number of nests laid for most of the Northwest Atlantic recovery units. The reasons for the declines are unknown as is whether the declines in nest counts reflect a decline in the number of adult females or a decline in the population or stock as a whole (letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007; NMFS and USFWS 2008).

As previously stated, loggerheads exist as five subpopulations in the western Atlantic, recognized as recovery units in the 2008 recovery plan for this species, that show limited evidence of interbreeding. The 2008 recovery plan compiled the most recent information on mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (i.e., nesting groups). They are: (1) for the NRU, a mean of 5,215 loggerhead nests per year with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatan, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatan since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit; however, the 2008 recovery plan indicates that the Yucatan nesting aggregation has at least 1,000 nesting females annually. It should be noted here, and it is explained further below, that the above numbers include nesting females (i.e., do not include non-nesting adult females, adult males, or juvenile males or females in the population).

It is likely that the sea turtles taken in the MSB fisheries originate from several of the recovery units. Limited information is available on the genetic makeup of sea turtles in the mid-Atlantic. Cohorts from each of the five western Atlantic subpopulations are expected to occur in the action area. Genetic analysis of samples collected from immature loggerhead sea turtles captured in pound nets in the Pamlico-Albemarle Estuarine Complex in North Carolina between 1995-1997 indicated that cohorts from all five western Atlantic subpopulations were present (Bass et al. 2004). In a separate study, genetic analysis of samples collected from loggerhead sea turtles from Massachusetts to Florida found that all five western Atlantic loggerhead subpopulations were represented (Bowen et al. 2004). Bass et al. (2004) found that 80 percent of the juveniles and sub-adults utilizing the foraging habitat originated from the south Florida nesting population, 12 percent from the northern subpopulation, 6 percent from the Yucatan subpopulation, and 2 percent from other rookeries. The previously defined loggerhead subpopulations do not share the exact delineations of the recovery units identified in the 2008 recovery plan. However, the PFRU is roughly equivalent to the south Florida subpopulation, the NRU is roughly equivalent to the northern nesting group, the Dry Tortugas subpopulation is equivalent to the DTRU, the Florida panhandle subpopulation is included in the NGMRU, and the Yucatan subpopulation is included in the GCRU.

Based on the genetic analysis presented in Bass et al. (2004) and the small number of loggerheads from the DTRU or the NGMRU likely to occur in the action area it is extremely unlikely that any of the up to 27 loggerheads that are likely to be seriously injured or killed due to MSB fishing operations are likely to have originated from either of these recovery units. The majority, at least 80% of the loggerheads seriously injured or killed, are likely to have originated from the PFRU, with the remainder from the NRU and GCRU. As such, 20 of the sea turtles are expected to be from the PFRU, 3 from the NRU and 2 from the GCRU. The best available information indicates that the proportion of the takes from each recovery unit are consistent with the relative sizes of the nesting colonies/recovery units, and we conclude, based on the available evidence, that none of the recovery units are disproportionately impacted by the take in the fisheries for Atlantic MSB. Therefore, our discussion of the impacts of the Atlantic mackerel, squid and butterfish fishery will focus on the overall western North Atlantic population of loggerhead sea turtles, which comprises these recovery units.

In determining whether the continued authorization of the Atlantic MSB fishery would reduce appreciably the likelihood of survival and recovery of loggerhead sea turtles, NMFS has considered the population viability analysis (PVA) for loggerhead sea turtles based on the impacts of the Atlantic sea scallop fishery (Merrick and Haas 2008). The PVA is similar to one that had been used to assess the effects of the Hawaii deep-set pelagic longline fishery on ESA-listed sea turtles, including loggerheads, in the Pacific (NMFS 2005b; Snover 2005). The PVA used to assess the effect of the continued authorization of the Atlantic sea scallop fishery and the Hawaii deep-set pelagic longline fishery on ESA-listed turtles in the Pacific assessed the female portion of the populations, only. A PVA for the whole Atlantic loggerhead population cannot be constructed since there are no estimates of the number of mature males, immature males, and immature females in the population, and the age structure of the population is unknown.

In using the PVA for making the jeopardy determination for the Biological Opinion for the Atlantic Sea Scallop FMP (NMFS 2009c), NMFS has:

- used quasi-extinction (the point at which so few animals remain that the species/population will inevitably become extinct) rather than extinction (the point at which no animals of that species/population are alive) as the reference point for survival;
- used three measures to assess the likelihood of quasi-extinction which are the probability of quasi-extinction (at 25, 50, 75, and 100 years), the median time to quasi-extinction, and the number of simulations with quasi-extinction probabilities at 25, 50, 75, or 100 years greater than 0.05; and,
- used statistical tests to inform whether any detected differences in the three measures for the comparison of the baseline to the baseline minus effects of the fishery are real.

The PVA was conducted for the adult female portion of loggerheads nesting in the western Atlantic Ocean. NMFS considered running the PVA at the nesting group level for the effects analysis, but did not pursue that option for two major reasons. First, sufficient data were not available to develop a PVA model for each of the nesting groups. Second, it was unclear how PVA outputs at a nesting group level could have been reconciled to assess the effects of a proposed action on the western Atlantic Ocean stock or the species overall. This is problematic because the jeopardy determination must ultimately be made at the species level.

Sufficient data were available to conduct a PVA of the northern nesting group and the South Florida nesting groups. It is unlikely that the results of a PVA on these two separate nesting groups would differ significantly from the results of the PVA on adult female loggerheads of the western Atlantic Ocean taken as a whole, for two reasons. First, the South Florida nesting group already drives the results of the western Atlantic Ocean analysis; index sites there represented 95% of the 2005 nests counted. As such, the viability of the South Florida nesting group would be very similar to that predicted for the overall western Atlantic Ocean stock of loggerheads. Second, the much smaller northern nesting group has shown considerable interannual variability in nest counts. Whether this is due to true environmental variability or process error is unknown. This high level of variability blurs our ability to detect real effects of an action, because high variance means that only large effects can be statistically significant. While it is likely that a PVA of the northern nesting group would show differences between the projected extinction risk with and without the takes from the summer flounder, scup and black sea bass fishery (as is the case with the PVA on adult female loggerheads nesting in the western Atlantic Ocean; see below), it is likely that these two projections would fall within the confidence intervals of each other. Therefore, these differences would not be statistically significant. In other words, given available data, any real effects of the fishery on quasi-extinction of adult female loggerhead sea turtles in the Atlantic are more likely to be discovered by conducting the PVA at the stock level (western North Atlantic) than if the PVA was conducted on the much smaller northern nesting group, alone, because conducting the PVA at the stock level reduces the variability thus improving the ability to detect real effects of the fishery.

The Atlantic sea scallop fishery PVA did not address loggerheads that nest in Greece, Turkey and Brazil since the PVA was performed for adult female loggerheads in the western Atlantic, only. Data to conduct a PVA for adult female loggerheads in the Atlantic as a whole are not available. However, given that the South Florida and northern nesting groups are the first and second largest of the loggerhead nesting groups in the Atlantic, respectively, the result of a PVA for adult female loggerheads in the Atlantic would be expected to be driven by the western Atlantic nesting groups even if data to conduct a PVA for the Atlantic as a whole were available. In short, the PVA established a baseline using the rate of change of the adult female population (which implicitly included the mortalities from the scallop and other fisheries), and the 2005 count of adult females estimated from all beaches in the Southeast U.S. based on an extrapolation from nest counts (Merrick and Haas 2008). The rate of change was then adjusted by adding back the fisheries take (converted to adult female equivalents), and re-running the PVA. The results of these two analyses were then compared. Values for inputs were used throughout such that the PVA would have been more, rather than less, likely to show a significant difference in quasi-extinction between the baseline and the baseline adjusted by adding back in the fisheries take. Using this approach, it was determined that both the baseline and adjusted baseline (adding back the fisheries take) had quasi-extinction probabilities of zero (0) at 25, 50, and 75 years, and a probability of 1% at 100 years. Median times to quasi-extinction were similar (207 years versus 240 years). Over 1,000 iterations of the model, the number of iterations with quasi-extinction probabilities at 100 years greater than 0.05 were higher for the baseline compared to the adjusted baseline (258 and 178, respectively) and were significantly different (Chi square = 18.3, P = 0.00) (Merrick and Haas 2008).

The results suggest that the continued authorization of the Atlantic scallop fishery, resulting in mortalities of loggerhead sea turtles, would not have an appreciable effect on the number of adult female loggerhead sea turtles in the western Atlantic over a future 100 years. While a statistically significant difference was detected in the number of iterations out of 1,000 with quasi-extinction probabilities at 100 years greater than 5%, the differences smoothed out over the 1,000 iterations and, taken together, the probability of quasi-extinction at 100 years is the same (1 %) under both baseline conditions, and when the baseline is adjusted by removing takes as a result of the scallop fishery. In addition, while median times to quasi-extinction differed between the baseline and the adjusted baseline, the difference was small and median times for both were greater than 200 years. Therefore, based on the median times to quasi-extinction, the PVA results indicated loggerhead sea turtles in the western Atlantic would not go extinct within the future 100 years regardless of the continued authorization of the scallop fishery.

The PVA demonstrated that the continued authorization of the Atlantic sea scallop fishery will not appreciably reduce the number of adult females in the western Atlantic compared to the numbers of adult females that would be present in the absence of the proposed action, even though the input values selected for the PVA (*e.g.*, number of nests per female, sex ratio, quasi-extinction level of 250 females) were chosen to maximize the chance that the PVA would show an effect from the fishery. The annual Atlantic MSB fishery bycatch of loggerhead sea turtles is estimated to be up to 62 individuals, resulting in up to 27 mortalities, which includes both male and female individuals, as well as juveniles and adults. The adult female equivalent of the 27 total mortalities has not been calculated, but assuming that approximately half of the takes are females, and that some portion of the takes are juveniles, the number of adult female equivalent mortalities is less than half of 27 and thus less than quarter of the adult female equivalent mortalities estimated for the Atlantic sea scallop fishery (approximately 100 adult female equivalents).

Estimates of the total loggerhead population in the Atlantic are not currently available. However, the 1998 TEWG report estimated the total loggerhead population of benthic individuals in U.S. waters – a subset of the whole Western Atlantic population – at over 200,000. Also, a recent loggerhead assessment prepared by NMFS states that the loggerhead adult female population in the western North Atlantic ranges from 20,000 to 40,000 or more, with a large range of uncertainty in total population size (NMFS SEFSC 2009). Also, a recent loggerhead assessment prepared by NMFS states that the loggerhead adult female population in the western North Atlantic ranges from 20,000 to 40,000 or more, with a 95% CI of 18,333-68,192 individuals (NMFS SEFSC 2009). Although there is much uncertainty in these population estimates, they provide some context for evaluating the size of the likely population of loggerheads in the Atlantic. Assuming that half the loggerheads taken in the fishery are females (data from takes in the scallop fishery supports this assumption), and assuming that all the takes are of adults to assume a worst case scenario as far as reproductive value to the population, the loggerhead mortality as a result of the Atlantic MSB fishery would result in the removal of 0.07 percent of the adult female loggerhead population in the Western Atlantic (13 out of 18,333, using the low end of the 95% CI from NMFS SEFSC 2009).

In general, while the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the species, this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of loggerhead sea turtles because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, and there are several thousand individuals in the population and subpopulaitons.

Scaled against the likely size of the population and the magnitude of the trends noted above, NMFS does not believe the level of SI/M takes projected annually from the continued authorization of the Atlantic MSB FMP (27 individuals) will have an appreciable reduction in the Northwest Atlantic or worldwide population. Therefore, the loss of up to 27 individuals per year is unlikely to cause an appreciable reduction in the species' likelihood of survival and recovery.

This conclusion is supported by comparing the impacts of the MSB to that of the scallop fishery. The PVA done for the scallop fishery, as described above, demonstrated that the continued authorization of that fishery would not appreciably reduce the number of adult females in the western Atlantic. The operation of the Atlantic MSB FMP is estimated to result in the mortality of less than a quarter of adult female equivalents compared to the scallop fishery.

The above information also supports the conclusion that continued authorization of the summer flounder, scup and black sea bass fisheries will have an insignificant effect on the number of nests and number of nesting females as listed in Demographic Criteria #1 of the 2008 recovery plan for loggerhead sea turtles in the Atlantic, as referenced earlier in this section. Likewise, this information supports the conclusion that the continued authorization of the Atlantic mackerel, squid and butterfish fishery will have an insignificant effect on the trends in abundance on foraging grounds as listed in Demographic Criteria #2 of the 2008 recovery plan.

The Listing Factor Recovery Criteria contained in the recovery plan include programs and strategies that should be implemented to respond to the following five listing factors that have caused loggerheads to be listed as a threatened species under the ESA: (1) present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) inadequacy of existing regulatory mechanisms, and (5) other natural or manmade factors affecting its continued existence. These programs involve both terrestrial and marine components (NMFS and USFWS 2008).

As described above and elsewhere in this Opinion, the continued operation of the Atlantic mackerel, squid and butterfish fishery is expected to harass, injure, or kill loggerhead sea turtles as a result of physical contact between the sea turtles and the fishing gear. No other effects to loggerhead sea turtles are expected as a result of the proposed action. The continued operation of the fishery will not affect the protection of nests, nesting beaches, and the marine environment nor will it compromise the ability of researchers to conduct scientific studies or management officials to enact peer-review strategies or legislative policy. Therefore, the continued operation of the fishery within the constraints of the current Atlantic MSB FMP will have no appreciable reduction in the ability to achieve the Listing Factor Recovery Criteria.

7.1.2 Leatherback Sea Turtle

There has been only one known take of leatherback sea turtles in gear targeting MSB since the completion of the last Opinion (1999). Reporting of sea turtle takes in the fishery on VTRs is non-existent, and observer coverage of the fishery has increased since 2004. Takes of leatherback sea turtles in the MSB fishery are reasonably likely to occur given: (1) that the distribution of leatherbacks overlaps with operation of MSB gear, and (2) a leatherback sea turtle was observed captured in bottom otter trawl gear used in both the squid fishery operating in Mid-Atlantic waters where the MSB fishery also operates.

Based on results from the U.S. south Atlantic and Gulf of Mexico shrimp trawl fisheries (Epperly *et al.* 2002; Sasso and Epperly 2006), any capture of a leatherback sea turtle in MSB trawl gear could result in death due to forced submergence, given that there are no regulatory controls on tow-times in the MSB fishery and trawl tows can be longer than one or two hours (NEFSC FSB database). In summary, based on the above captures in bottom otter trawl gear within waters of the action area, the continued operation of the MSB fishery under the MSB FMP is anticipated to result in the annual non-lethal/or lethal take of up to 2 leatherback sea turtles.

The lethal removal of 2 leatherback sea turtle annually, whether male or female or immature or mature, would be expected to reduce the number of Atlantic leatherback sea turtles as compared to the number of leatherback sea turtles in the Atlantic that would have been present in the absence of the proposed action assuming all other variables remained the same. The loss of 2 female leatherback sea turtles, annually, would be expected to reduce the reproduction of Atlantic leatherback sea turtles as compared to the reproductive output of leatherback sea turtles in the Atlantic in the absence of the proposed action. The lethal removal of 2 leatherback sea turtle annually from the Atlantic as a result of the continued operation of the MSB fishery will not appreciably reduce the likelihood of survival for the species for the following reasons. Unlike leatherbacks in the Pacific, the nesting trend (in terms of number of nests laid) for leatherbacks in the Atlantic is stable or increasing for nearly all Atlantic leatherback nesting sites. The TEWG (2007) report identified seven leatherback populations or groups of populations in the Atlantic: Florida, North Caribbean, Western Caribbean, Southern Caribbean, West Africa, South Africa, and Brazil. The leatherback TEWG concluded that there was an increasing or stable trend in nesting for all of these with the exception of the Western Caribbean and West Africa. For example, the Florida Statewide Nesting Beach Survey Program has documented an increase in leatherback nesting numbers in that state from 98 in 1988 to between 800 and 900 nests in the early 2000s (NMFS and USFWS 2007b). In 2001, the number of nests for Suriname and French Guiana, the largest known nesting areas for leatherbacks worldwide, was 60,000 (Hilterman and Goverse 2004).

This is one of the highest numbers observed for this region in 35 years (Hilterman and Goverse 2004). A stable trend in nesting suggests that leatherbacks are able to maintain current levels of nesting as well as current numbers of adult females despite on-going activities as described in the *Environmental Baseline*, *Cumulative Effects*, and the *Status of the Species* (for those activities that occur outside of the action area of this Opinion). An increasing trend in nesting suggests that the combined impact to Atlantic leatherbacks from these on-going activities is less than what has occurred in the past. The result of which is that more female leatherbacks are maturing and subsequently nesting, and/or are surviving to an older age and producing more nests across their lifetime.

As described in the *Status of the Species* and *Environmental Baseline*, action has been taken to reduce anthropogenic effects to Atlantic leatherbacks. These include regulatory measures to reduce the number and severity of leatherback interactions with the two leading known causes of leatherback fishing mortality in the Atlantic: the U.S. Atlantic longline fisheries (measures first implemented in 2000 and subsequently revised) and the U.S. south Atlantic and Gulf of Mexico shrimp fisheries (measures implemented in 2002). Reducing the number of leatherback sea turtles injured and killed as a result of these activities is expected to increase the number of Atlantic leatherbacks, and increase leatherback reproduction in the Atlantic. Since the regulatory measures are relatively recent, it is unlikely that current nesting trends reflect the benefit of these actions to Atlantic leatherbacks. Therefore, the current nesting trends for Atlantic leatherbacks are likely to improve as a result of regulatory action taken for the U.S. Atlantic longline fisheries and the U.S. south Atlantic and Gulf of Mexico shrimp fisheries. There are no new known sources of injury or mortality for leatherback sea turtles in the Atlantic.

Based on the information provided above, the loss of 2 leatherback sea turtle annually in the Atlantic as a result of the continued operation of the MSB fishery will not appreciably reduce the likelihood of survival for leatherbacks in the Atlantic given the increased and stable nesting trend at the Atlantic nesting sites, and given measures that reduce the number of Atlantic leatherback sea turtles injured and killed in the Atlantic (which should result in increases to the numbers of leatherbacks in the Atlantic that would otherwise have not occurred in the absence of those regulatory measures). The MSB fishery has no effects on leatherback sea turtles that occur outside of the Atlantic. Therefore, since the continued operation of the MSB fishery will not appreciably reduce the likelihood of survival for leatherbacks in the Atlantic, the proposed action will not appreciably reduce the likelihood of survival of the species.

The 5-year status review for the species reviewed the recovery criteria provided with the 1992 recovery plan for leatherbacks in the Atlantic, and the progress made in meeting each objective (NMFS and USFWS 2007b). These are: (1) the adult female population increases over the next 25 years as evidenced by a statistically significant trend in the number of nests at Culebra (Puerto Rico), St. Croix (U.S. Virgin Islands), and along the east coast of Florida; (2) nesting habitat encompassing at least 75% of nesting activity in Puerto Rico, U.S. Virgin Islands, and Florida is in public ownership; (3) all priority one tasks have been implemented (address a multitude of measures in areas of nesting habitat protection, scientific studies, marine debris, oil and gas exploration, amongst others) (NMFS and USFWS 1992). As described in this Opinion, the continued operation of the MSB fishery could kill up to 2 leatherback sea turtle annually. No other effects to leatherbacks are expected as a result of the proposed action. The continued operation of the MSB fishery will not affect ownership of nesting habitat, nor will it affect the protection of nesting beaches and the marine environment or compromise the ability of researchers to conduct scientific studies. Therefore, the continued operation of the MSB fishery within the constraints of the FMP will have no effect on recovery criteria #2 and #3.

The lethal (or non-lethal) take of up to 2 leatherback sea turtles, annually, as a result of the proposed action is expected to reduce the number of leatherbacks in the Atlantic compared to the number that would have been present in the absence of the proposed action, and will, similarly, reduce leatherback reproduction in the Atlantic as a result of the capture and killing if the leatherback is a female. These conclusions are relevant to recovery criteria #1 of the 1992 recovery plan for leatherbacks in the Atlantic. As described in the 5-year status review, the number of nests counted in Puerto Rico increased from 9 in 1978 to a minimum of 469-882 nests recorded each year from 2000-2005. Based on the nesting numbers, the annual female population growth rate was positive for the 28-year time period from 1978-2005. In St. Croix, U.S. Virgin Islands, leatherback nesting increased from a low of 143 in 1990 to a high of 1,008 in 2001. Based on the nesting numbers, the annual female population growth rate was positive for the 19-year time period from 1986-2004. In Florida, nests have increased from 98 nests in 1989 to 800-900 nests per season in the early 2000s (NMFS and USFWS 2007b). Based on the nesting numbers, the annual female population growth rate was positive for the 18-year time period from 1989-2006 (NMFS and USFWS 2007b). The annual loss of up to 2 leatherback sea turtles, together with an increase in nesting, is not expected to affect the positive growth rate in the female population of leatherback sea turtles nesting in Puerto Rico, St. Croix, and Florida. Therefore, the continued operation of the MSB fishery within the constraints of the current MSB FMP will not appreciably reduce the likelihood of recovery for leatherback sea turtles in the Atlantic. Since the MSB fishery has no effects on leatherback sea turtles that occur outside of the Atlantic, its continued operation will not appreciably reduce the likelihood of recovery for the species.

7.1.3 Kemp's Ridley Sea Turtle

There have been no known takes of Kemp's ridley sea turtles in gear targeting MSB. The distribution of Kemp's ridleys overlaps seasonally with the use of MSB gear, and Kemp's ridley sea turtles are captured in other types of gear (e.g., trawls etc.). Based on recent observer data, the capture of Kemp's ridley sea turtles in fixed or mobile gear operating within the action area, including MSB gear, is infrequent. Based on these data as well as recent incidental take reports, it is NMFS's Opinion that up to 2 (lethal or non-lethal) Kemp's ridley sea turtles are anticipated to be taken annually as a result of the continued authorization of the MSB fishery.

Based on results from the U.S. south Atlantic and Gulf of Mexico shrimp trawl fisheries (Epperly *et al.* 2002; Sasso and Epperly 2006), any capture of a Kemp's ridley sea turtle in MSB trawl gear could result in death due to forced submergence, given that there are no regulatory controls on tow-times in the MSB trawl fishery and some trawl tows that have been observed to take loggerhead sea turtles have exceeded one hour in duration (NEFSC FSB database). It is assumed that there is an equal chance of lethally taking male or female Kemp's ridley sea turtles since available information suggests that both sexes occur in the action area. Kemp's ridley sea turtles taken as a result of MSB gear are expected to be immatures or adults depending upon where they are taken. If taken in the Mid-Atlantic and New England regions, they are likely to be immatures. If taken in the South Atlantic region, they are likely to be either immatures or adults.

The lethal removal of up to 2 Kemp's ridley sea turtles annually, whether males or females, immature or mature animal, would be expected to reduce the number of Kemp's ridley sea turtles as compared to the number of Kemp's ridleys that would have been present in the absence of the proposed action assuming all other variables remained the same. The loss of up to 2 female Kemp's ridley sea turtles, annually, would be expected to reduce the reproduction of Kemp's ridley sea turtles as compared to the reproductive output of Kemp's ridley sea turtles in the absence of the proposed action. The lethal removal of up to 2 Kemp's ridley sea turtles annually as a result of the continued authorization of the MSB fishery will not appreciably reduce the likelihood of survival for the species for the following reasons. From 1985 to 1999, the number of Kemp's ridley nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3% per year. An estimated 4,047 females nested in 2006 and an estimated 5,500 females nested in Tamaulipas (the primary but not sole nesting site) over a 3-day period in May 2007 (NMFS and USFWS 2007c). Based on the number of nests laid in 2006 and the remigration interval for Kemp's ridley sea turtles, there were an estimated 7,000-8,000 adult female Kemp's ridleys in 2006 (NMFS and USFWS 2007c). The observed increase in nesting of Kemp's ridley sea turtles suggests that the combined impact to Kemp's ridley sea turtles from on-going activities as described in the *Environmental Baseline*, *Cumulative Effects*, and the *Status of the Species* (for those activities that occur outside of the action area of this Opinion) are less than what has occurred in the past. The result of which is that more female Kemp's ridley sea turtles are maturing and subsequently nesting, and/or are surviving to an older age and producing more nests across their lifetime.

As described in the *Status of the Species* and *Environmental Baseline*, action has been taken to reduce anthropogenic effects to Kemp's ridley sea turtles. These include regulatory measures implemented in 2002 to reduce the number and severity of Kemp's ridley sea turtle interactions in the U.S. south Atlantic and Gulf of Mexico shrimp fisheries, a leading known cause of Kemp's ridley sea turtle mortality. Since these regulatory measures are relatively recent, it is unlikely that current nesting trends reflect the benefit of these measures to Kemp's ridley sea turtles. Therefore, the current nesting trends for Kemp's ridley sea turtles are likely to improve as a result of regulatory action taken for the U.S. south Atlantic and Gulf of Mexico shrimp fisheries. There are no new known sources of injury or mortality for Kemp's ridley sea turtles.

Based on the information provided above, the loss of up to 2 Kemp's ridley sea turtles annually as a result of the continued authorization of the MSB fishery will not appreciably reduce the likelihood of survival for Kemp's ridley sea turtles given both the increased nesting trend and ongoing measures that reduce the number of Kemp's ridley sea turtles injured and killed (which should result in increases to the numbers of Kemp's ridley sea turtles that would not have occurred in the absence of those regulatory measures).

Section 4(a)(1) of the ESA requires listing of a species if it is endangered or threatened because of any of the following five listing factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, or (5) other natural or manmade factors affecting its continued existence. NMFS is using these factors to assess whether the continued authorization of the MSB fishery will appreciably reduce the likelihood of recovery for the species given that recovery is defined as improvement in the status of the listed species to the point at which listing is no longer appropriate under the criteria seat out in section 4(a)(1) of the ESA (50 CFR 402.02).6 As described in this Opinion, the continued authorization of the MSB fishery is expected to kill up to 2 Kemp's ridley sea turtle annually. No other effects to Kemp's ridley sea turtles, such as on habitat, or due to disease, predation, and other natural influences on survival, are expected as a result of the proposed action. The loss of 2 Kemp's ridleys annually is not expected to modify, curtail, or destroy their range. The MSB fishery does not utilize Kemp's ridleys for recreational, scientific, or commercial purposes, or affect the adequacy of existing regulatory mechanisms to protect them. Therefore, the continued authorization of the MSB fishery will have no effect on ESA listing criteria #1 through #4.

The lethal taking of up to 2 Kemp's ridley sea turtles annually in the MSB fishery is expected to reduce the number of Kemp's ridley sea turtles compared to the number that would have been present in the absence of the proposed action, and will, similarly, reduce Kemp's ridley reproduction as a result of the capture and killing if the Kemp's ridley sea turtles are females. These conclusions are relevant to listing factor #5 of the ESA. As described in the 5-year status review, Kemp's ridley sea turtles are experiencing considerable increases in nesting (NMFS and USFWS 2007c). From 1985 to 1999, the number of Kemp's ridley nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3% per year. Nesting has increased from 247 nesting females in the 1985 nesting season to 4,047 nesting females in 2006. In May 2007, an estimated 5,500 females nested in Tamaulipas (the primary, but not sole nesting site) over a 3-day period (NMFS and USFWS 2007c). Based on the number of nests laid in 2006 and the remigration interval for Kemp's ridley sea turtles, there were an estimated 7,000-8,000 adult female Kemp's ridleys in 2006 (NMFS and USFWS 2007c). The observed increase in nesting of Kemp's ridley sea turtles suggests that the manmade factors which contributed to its being listed under the ESA as an endangered species have been reduced to the extent that more female Kemp's ridley sea turtles are reaching maturity and nesting and/or mature females are living longer, thus producing more nests over their lifetime. The loss of 2 Kemp's ridleys annually is not expected to change or effect nesting especially if the Kemp's ridley killed in the MSB fishery are male. The loss of 2 Kemp's ridleys will not compromise the continued existence of the species, which is the focus of the listing factor #5. Therefore, the continued authorization of the MSB fishery will not appreciably reduce the likelihood of recovery for the species.

7.1.4 Green Sea Turtle

There have been no known takes of green sea turtles in gear targeting MSB. The distribution of green sea turtles overlaps seasonally with the use of MSB gear, and green sea turtles are captured in other types of gear (e.g. trawls) which capture MSB as a non-target species. Based on observer data, the capture of green sea turtles in any gear (fixed or mobile) operating within the action area, including MSB gear, would be a rare event. However, given the low level of observer coverage in the MSB fishery as well as other fisheries in the action area, it is likely that some interactions have occurred but were not observed or reported. Based on the average of the number of takes per year in gear capable of catching MSB for the period 2000-2009, 2 takes of green sea turtles in MSB gear are anticipated to occur annually as a result of the continued authorization of the MSB fishery. It is assumed that there is an equal chance of lethally taking a male or female green sea turtle since available information suggests that both sexes occur in the action area. Green sea turtles taken as a result of MSB trawl gear are expected to be either neritic immatures or adults.

The lethal removal of up to 2 green sea turtle annually from the Atlantic, whether male or females, immature or mature animal, would be expected to reduce the number of green sea turtles in the Atlantic as compared to the number of green sea turtles that would have been present in the absence of the proposed action assuming all other variables remained the same.

The loss of up to 2 female green sea turtles, annually, would be expected to reduce the reproduction of green sea turtles in the Atlantic as compared to the reproductive output of green sea turtles in the Atlantic in the absence of the proposed action. The lethal removal of up to 2 green sea turtles annually from the Atlantic as a result of the continued authorization of the MSB fishery will not appreciably reduce the likelihood of survival for the species for the following reasons. Unlike green sea turtles that occur elsewhere in the species range, green turtle nesting in the Atlantic shows a generally positive trend during the ten years of regular monitoring since establishment of the index beaches in 1989 (Meylan *et al.* 1995). In the continental U.S., an average of 5,039 nests have been laid annually in Florida between 2001-2006 with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007d). Seminoff (2004) reviewed green turtle nesting at five western Atlantic sites. All of these showed increased nesting compared to prior estimates with the exception of nesting at Aves Island, Venezuela (Seminoff 2004). The most important nesting concentration for green sea turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007d). Nesting in the area has increased considerably since the 1970s and nest count data from 1990-2003 suggests that 17,402-37,290 adult females nested each year (NMFS and USFWS 2007d). The observed increase in nesting of Atlantic green sea turtles suggests that the combined impact to Atlantic green sea turtles from on-going activities as described in the *Environmental Baseline*, *Cumulative Effects*, and the *Status of the Species* (for those activities that occur outside of the action area of this Opinion) are less than what has occurred in the past. The result of which is that more female green sea turtles are maturing and subsequently nesting, and/or are surviving to an older age and producing more nests across their lifetime.

As described in the *Status of the Species* and *Environmental Baseline*, action has been taken to reduce anthropogenic effects to green sea turtles in the Atlantic. These include regulatory measures implemented in 2002 to reduce the number and severity of green sea turtle interactions in the U.S. south Atlantic and Gulf of Mexico shrimp fisheries, a leading known cause of green sea turtle mortality in the Atlantic. Since these regulatory measures are relatively recent, it is unlikely that current nesting trends reflect the benefit of these measures to Atlantic green sea turtles. Therefore, the current nesting trends for green sea turtles in the Atlantic are likely to improve as a result of regulatory action taken for the U.S. south Atlantic and Gulf of Mexico shrimp fisheries. There are no new known sources of injury or mortality for green sea turtles in the Atlantic.

Based on the information provided above, the loss of up to 2 green sea turtles annually in the Atlantic as a result of the continued authorization of the MSB fishery will not appreciably reduce the likelihood of survival for green sea turtles in the Atlantic given the increased nesting trend at the Atlantic nesting sites, and given measures that reduce the number of Atlantic green sea turtles injured and killed in the Atlantic (which should result in increases to the numbers of green sea turtles in the Atlantic that would otherwise have not occurred in the absence of those regulatory measures). The MSB fishery has no effect on green sea turtles that occur outside of the Atlantic. Therefore, since the continued authorization of the MSB fishery will not appreciably reduce the likelihood of survival of green sea turtles in the Atlantic, the proposed action will not appreciably reduce the likelihood of survival for the species.

The 5-year status review for the species reviewed the recovery criteria provided with the 1991 recovery plan for green sea turtles in the Atlantic, and the progress made in meeting each objective (NMFS and USFWS 2007d). These are that the U.S. population of green sea turtles can be considered for delisting if, over a period of 25 years, the following conditions are met: (1) the level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years; (2) at least 25% (105 km) of all available nesting beaches (420 km) is in public ownership and encompasses greater than 50% of the nesting activity; (3) a reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds; and (4) all priority one tasks have been successfully implemented (these address a multitude of measures in areas of nesting habitat, marine habitat, disease, species protection, data collection and management amongst others; NMFS and USFWS 1991b). As described in this Opinion, the continued authorization of the MSB fishery is expected to kill up to 2 Atlantic green sea turtles annually. No other effects to green sea turtles are expected as a result of the proposed action. The continued authorization of the MSB fishery will not affect ownership of nesting habitat, nor will it affect the protection of nesting beaches and the marine environment or compromise the ability of researchers to conduct scientific studies. Therefore, the continued authorization of the MSB fishery will have no effect on recovery criteria #2 and #4.

The lethal taking of up to 2 green sea turtles annually in the MSB fishery is expected to reduce the number of green sea turtles in the Atlantic compared to the number that would have been present in the absence of the proposed action, and will, similarly, reduce green sea turtle reproduction in the Atlantic as a result of the capture and killing if the green sea turtles are females. These conclusions are relevant to recovery criteria #1 and #3 of the 1991 recovery plan for green sea turtles in the Atlantic. As described in the 5-year status review for the species (NMFS and USFWS 2007d), an average of 5,039 green sea turtle nests have been laid annually over the past 6 years in Florida. Thus, recovery criteria #1 has been met, and the annual loss of 2 green sea turtles which may be male or female, mature or immature, is not expected to materially affect the 6-year average of nests on Florida beaches. With respect to recovery criteria #3, there is evidence of substantial increases in the number of green sea turtles on foraging grounds within the western Atlantic. Ehrhart *et al.* (2007) found a 661% increase in juvenile green sea turtle capture rates in the central region of the Indian River Lagoon (along the east coast of Florida) over the 24-year study period from 1982-2006. Wilcox *et al.* (1998) found a dramatic increase in the number of green sea turtles captured from the intake canal of the St. Lucie nuclear power plant on Hutchinson Island, Florida beginning in 1993. During the 16-year period from 1976-1993, green sea turtle captures averaged 24 per year (Wilcox *et al.* 1998). The green turtle catch for 1993, 1994, and 1995 was 745%, 804%, and 2,084%, respectively, above the previous 16-year average annual catch (Wilcox *et al.* 1998). Such changes are not as dramatic elsewhere. In a study of sea turtles incidentally caught in pound net gear fished in inshore waters of Long Island, NY, Morreale *et al.* (2004) documented the capture of more than twice as many green sea turtles in 2003 and 2004 with less pound net gear fished, compared to the number of green sea turtles captured in pound net gear in the area during the 1990s. Yet other studies have found no difference in the abundance (decreasing or increasing) of green sea turtles on foraging grounds in the Atlantic (Bjorndal *et al.* 2005; Epperly *et al.* 2007). The annual loss of 2 green sea turtle, together with an increase in nesting, is not expected to materially affect the increasing to stable trend in the number of green sea turtles on the foraging grounds in the Atlantic. Therefore, the continued authorization of the MSB fishery will not appreciably reduce the likelihood of recovery for green sea turtles in the Atlantic. Since the MSB fishery has no effects on green sea turtles that occur outside of the Atlantic, the continued authorization of the MSB fishery will not appreciably reduce the likelihood of recovery for the species.

8.0 CONCLUSION

After reviewing the best available information on the status of endangered and threatened species under NMFS' jurisdiction, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is NMFS' Biological Opinion that the operation of the federal Atlantic MSB fishery under the MSB FMP may adversely affect but is not likely to jeopardize the continued existence of the loggerhead sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, and green sea turtle.

Proposed Rule to List Loggerhead Sea Turtles

As explained in *Status of Affected Species* section of this Opinion, on March 16, 2010, NMFS published a proposed rule to list two distinct population segments of loggerhead sea turtles as threatened and seven distinct population segments of loggerhead sea turtles as endangered. This rule, when finalized, would replace the existing listing for loggerhead sea turtles. Currently, the species is listed as threatened range-wide. Once a species is proposed for listing, the conference provisions of the ESA apply. As stated at 50 CFR 402.10, "Federal agencies are required to confer with NMFS on any action which is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat. The conference is designed to assist the Federal agency and any applicant in identifying and resolving potential conflicts at an early stage in the planning process."

As described in this Opinion, the proposed action is anticipated to result in the death of no more than 27 loggerhead sea turtles on an annual basis. In this Opinion, NMFS concludes that this level of take is not likely to reduce appreciably the likelihood of both the survival and recovery of the species in the wild by reducing the reproduction, numbers, or distribution of that species and that, therefore, the action is not likely to jeopardize the continued existence of loggerhead sea turtles.

As explained in the Opinion, the takes and mortalities caused by the proposed action are all likely to fall within the Northwest Atlantic DPS, one of the seven DPSs proposed to be listed as endangered in the March 16, 2010 proposed rule. In this Opinion, NMFS determined that the loss of these individuals would not be detectable at the population (Western North Atlantic) level or at the species as whole (i.e., range-wide) and that the death of up to 27 loggerhead sea turtles each year as a result of the continued operation of the Atlantic mackerel, squid and butterfish fishery will not appreciably reduce the likelihood of survival (i.e., it will not increase the risk of extinction faced by this species) or recovery for loggerhead sea turtles. As explained in the Opinion, the individuals likely to be killed represent .05 percent of the adult females in the Northwest Atlantic. The proposed Northwest Atlantic DPS is roughly equivalent to the Northwest Atlantic population, as defined in the Recovery Plan. Thus, the individuals likely to be killed represent no more than 0.05% of the adult female loggerhead sea turtles in the proposed Northwest Atlantic DPS. In this Opinion NMFS determines that the loss of these individuals from the population (as defined in the Recovery Plan) was likely to be undetectable; as such, and given that the proposed DPS is roughly equivalent, it is reasonable to expect that the conclusions reached for the Northwest Atlantic population and current range-wide listing would be the same as for the proposed Northwest Atlantic DPS.

Conference is only required when an action is likely to jeopardize the continued existence of any proposed species, and, based on the above information, it is unlikely that the effects of the proposed action would result in jeopardy for the proposed Northwest Atlantic DPS. Thus, conference is not required for this proposed action. Additionally, as ITS included with this Opinion contains all terms and conditions and reasonable and prudent measures necessary and appropriate to minimize and monitor take of loggerhead sea turtles, it is unlikely that a conference would identify or resolve additional conflicts or provide additional means to minimize or monitor take of loggerhead sea turtles.

9.0 INCIDENTAL TAKE STATEMENT

Section 9 of the Endangered Species Act and federal regulations pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the execution of an otherwise lawful activity. Under the terms of Sections 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS).

The measures described below are non-discretionary and must be undertaken by NMFS in a manner that they become binding conditions, so that, the exemption in section 7(o)(2) will apply. NMFS has a continuing duty to regulate the activity covered by this ITS. If NMFS fails to assume and implement the terms and conditions through enforceable terms, the protective coverage of section 7(o)(2) may lapse.

When a proposed NMFS action which may incidentally take individuals of a listed species is found to be consistent with section 7(a)(2) of the ESA, section 7(b)(4) of the ESA requires NMFS to issue a statement specifying the impact of any incidental taking. It also states that reasonable and prudent measures necessary to minimize such impacts be provided along with implementing terms and conditions. Only those incidental takes resulting from the agency action (including those caused by activities approved by the agency) that are identified in this statement and are in compliance with the specified reasonable and prudent measures and terms and conditions are exempt from the takings prohibition of Section 9(a), pursuant to section 7(o) of the ESA.

9.1 Anticipated Amount or Extent of Incidental Take

Based on the Murray (2006, 2008) reports, incidental capture data from observer reports for the MSB and other similar fisheries, and the distribution and abundance of sea turtles in the action area, NMFS anticipates that the continued operation of the MSB fishery within the constraints of the current MSB FMP may result in the incidental take of sea turtles as follows:

- for loggerhead sea turtles, NMFS anticipates the annual capture of up to 62 individuals annually (from a 5 year average). Of these 62 loggerheads, 27 are expected to die or be seriously injured as a result of being captured in either bottom trawl or other MSB gear type;

- for leatherback sea turtles, NMFS anticipates the annual lethal or non-lethal capture of up to 2 individuals in either bottom trawl or other MSB gear type;

- for Kemp's ridley sea turtles, NMFS anticipates the annual lethal or non-lethal capture of up to 2 individuals in either bottom trawl or other MSB gear type; and,

- for green sea turtles, NMFS anticipates the annual lethal or non-lethal capture of up to 2 individuals in either bottom trawl or other MSB gear type.

9.2 Anticipated Impact of Incidental Take

NMFS has concluded that the continued operation of the MSB fishery within the constraints of the current MSB FMP may adversely affect, but is not likely to jeopardize, loggerhead, leatherback, Kemp's ridley, or green sea turtles. Nevertheless, NMFS must take action to minimize these takes. The following Reasonable and Prudent Measures (RPMs) have been identified as ways to minimize sea turtle interactions with the MSB fishery now and to generate the information necessary in the future to continue to minimize incidental takes. These measures are non-discretionary and must be implemented by NMFS. Some of these measures were included as RPMs with the 1999 Opinion. They are repeated here because they still meet the criteria for a RPM and reflect work in progress to minimize the taking of sea turtles in MSB fishing gear.

The accompanying Opinion evaluated the effects of this level of take on these threatened and endangered species and has determined that this level of anticipated take is not likely to result in jeopardy to any of the species.

9.3 Reasonable and Prudent Measures

NMFS has determined that the following RPMs are necessary or appropriate to minimize impacts of the incidental take of sea turtles in the MSB fishery:

1. NMFS must seek to ensure that any sea turtles incidentally taken in Atlantic mackerel, squid and butterfish fishing gear are handled in such a way as to minimize stress to the animal and increase its survival rate.

2. NMFS must seek to ensure that monitoring and reporting of any sea turtles encountered in Atlantic mackerel, squid and butterfish fishing gear: (1) detects any adverse effects such as injury or mortality; (2) assesses the realized level of incidental take in comparison with the anticipated incidental take documented in this Opinion; and (3) detects whether the anticipated level of take has occurred or been exceeded; and (4) collects data from individual encounters.

3. NMFS must continue to investigate and implement, within a reasonable time frame following sound research, gear modifications for gear used in the Atlantic mackerel, squid and butterfish fishery to reduce incidental takes of sea turtles and/or the severity of the interactions that occur.

4. NMFS must continue to review available data to determine whether there are areas or conditions within the action area where sea turtle interactions with fishing gear used in the Atlantic mackerel, squid and butterfish fishery are more likely to occur.

NMFS anticipates that not more than 62 loggerhead sea turtles and two green sea turtles, two Kemp's ridley sea turtles, and two leatherback sea turtles (lethal or/non-lethal) will be incidentally taken in any given year as a result of the federal MSB fishery managed under the proposed FMP. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might result from the proposed action. If, during the course of the MSB fishery, this level of incidental take is exceeded, the additional level of take would represent new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided above.

9.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, and regulations issued pursuant to section 4(d), NMFS and the fishers within the fishery must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. To comply with RPM #1 above, NMFS should distribute information to MSB permit holders specifying handling or resuscitation requirements fishermen must undertake for any sea turtles taken. At a minimum, handling and resuscitation requirements listed in 50 CFR 223.206(d)(1) must be implemented. Use of the sea turtle handling and release protocols described in Epperly et al. (2004) and NMFS SEFSC (2008) should also be considered. Implementation of these requirements must occur as soon as operationally feasible and no later than March 31, 2011.

2. To also comply with RPM #1 above, NMFS must develop and implement an outreach program to train commercial fishermen in the use of any sea turtle release equipment and/or sea turtle handling protocols and guidelines implemented. The Northeast Fisheries Observer Program (NEFOP) has acknowledged that they would be willing to help with this initiative. In developing and implementing this outreach program, the HMS pelagic longline educational outreach program should be used as a model. The outreach program must be implemented in conjunction with term and condition # 1.

3. To comply with RPM #2 above, NMFS will continue to ensure that there is adequate observer coverage in Mid-Atlantic trawl, dredge and gillnet fisheries to document and estimate incidental bycatch of loggerhead sea turtles. Monthly summaries and an annual report of observed sea turtle takes in New England and Mid-Atlantic fisheries, including trips where MSB species are landed, should continue to be provided to the NERO Protected Resources Division.

4. To also comply with RPM #2 above, observers must continue to tag and take tissue samples from incidentally captured sea turtles as stipulated under their ESA Section 10 permit. The current NEFOP protocols are to tag any sea turtles caught that are larger than 26 centimeters (cm) in notch-to-tip carapace length and to collect tissue samples for genetic analysis from any sea turtles caught that are larger than 25 cm in notch-to-tip carapace length. The NEFSC shall be the clearinghouse for any genetic samples taken.

5. To also comply with RPM #2 above, NMFS must continue to develop and implement sea turtle serious injury criteria for fisheries in the NE Region in order to better assess and evaluate injuries sustained by sea turtles in fishing gear, and their potential impact on sea turtle populations.

6. Bycatch estimates need to be combined with quantitative stock assessments to provide improved understanding of how listed species are adversely affected by estimated bycatch levels. Thus, to also comply with RPM #2 above, NMFS must improve its quantitative stock assessment of incidentally caught species. A sufficient quantitative stock assessment includes, but is not limited to, an integrative modeling framework for quantitative stock assessment and the necessary fishery independent data needed to support such assessments. Progress towards this goal must be reported on annually.

7. To comply with RPM #3 above, NMFS will continue to investigate modifications of trawl gear type used in the MSB fishery and its effects on sea turtles through research and

development, as resources allow. Within a reasonable amount of time following completion of an experimental gear trial from or by any source, NMFS will review all data collected from the experimental gear trials, determine the next appropriate course of action (e.g., expanded gear testing, further gear modification, rulemaking to require the gear modification), and initiate action based on the determination.

8. To comply with RPM #4 above, NMFS must continue to review all data available on the observed/documented take of sea turtles in trawl gear in the MSB fisheries and other suitable information (*i.e.*, data on observed sea turtle interactions for other fisheries, vertical line density information, sea turtle distribution information, or fishery surveys in the area where the MSB fishery operates to assess whether there is sufficient information to undertake any additional analysis to attempt to identify correlations with environmental conditions or other drivers of incidental take within some or all of the action area. If such additional analysis is deemed appropriate, within a reasonable amount of time after completing the review, NMFS will take appropriate action to reduce sea turtle interactions and/or their impacts.

9.5 Monitoring

NMFS must continue to monitor levels of sea turtle bycatch in the MSB fishery. Observer coverage has been used as the principal means to estimate sea turtle bycatch in the MSB fishery and to monitor incidental take levels provided in this and in the 1999 Opinion for the fishery. NMFS will continue to use observer coverage to monitor sea turtle bycatch in commercial trawl gear that catches MSB as both a target and non-target species.

NMFS should also continue to support NEFOP's development of a video monitoring pilot project to evaluate its utility for various fishing gear types including bottom otter trawls. If video monitoring proves to be a feasible supplement to observer coverage, the utility of video in identifying sea turtle bycatch events could be investigated. In the future, video could potentially be used to evaluate compliance with VTR requirements for incidentally taken sea turtles.

For the purposes of monitoring this ITS, NMFS will continue to use observer coverage as the primary means of collecting incidental take information. The loggerhead sea turtle take estimates in the Opinion were generated using statistical estimates that are not feasible to conduct on an annual basis. Conducting such statistical estimates are infeasible on an annual basis due to the data needs, length of time to develop, review, and finalize the estimates, and methodology used. As these estimates depend on take rate information over a several year period, re-examination after one year is not likely to produce any noticeable change in the take rate. For these reasons, approximately every 5 years, NMFS will re-estimate takes in the MSB fishery using appropriate statistical methods. A new bycatch estimate for loggerhead sea turtles caught in trawl gear is scheduled to be completed in 2011. A revised estimate for gillnet gear will be completed within 5 years since the publication of Murray (2009a). For the years in-between estimates, and for species other than loggerheads, NMFS will use all available information (*e.g.*, observed takes, changes in fishing effort, etc.) to determine if the annual incidental take level in this Opinion has been met or exceeded. NMFS will append each year's determination to this Opinion.

10.0 CONSERVATION RECOMMENDATIONS

In addition to section 7(a)(2), which requires agencies to ensure that proposed actions are not likely to jeopardize the continued existence of listed species, section 7(a)(1) of the ESA places a responsibility on all federal agencies to utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. Conservation Recommendations are discretionary activities designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The following additional measures are recommended regarding incidental take and sea turtle conservation:

1. NMFS should continue to collect and analyze biological samples from sea turtles incidentally taken in fishing gear targeting monkfish to determine the nesting origin of sea turtles taken in the monkfish fishery in order to better assess the effects of the fishery on nesting groups and address those effects accordingly. NMFS should review its policies/protocols for the processing of genetics samples to determine what can be done to improve the efficiency and speed for obtaining results of genetic samples taken from all incidentally taken sea turtles.

2. NMFS should establish a protocol for bringing to shore any sea turtle incidentally taken in monkfish fishing gear that is fresh dead, that dies on the vessel shortly after the gear is retrieved, or dies following attempts at resuscitation in accordance with the regulations. Such protocol should include the steps to be taken to ensure that the carcass can be safely and properly stored on the vessel, properly transferred to appropriate personnel for examination, as well as identify the purpose for examining the carcass and the samples to be collected. Port samplers and observers should also be trained in the protocols for notification of the appropriate personnel in the event that a vessel comes into port with a sea turtle carcass.

3. NMFS should work with the states to promote the permitting of activities (*e.g.*, state permitted fisheries, state agency in-water surveys) that are known to incidentally take ESA-listed species.

4. NMFS should support studies on seasonal sea turtle distribution and abundance in the action area, behavioral studies to improve our understanding of ESA-listed species interactions with fishing gear, foraging studies including prey abundance/distribution studies (which may influence distribution), as well as studies and analysis necessary to develop population estimates for sea turtles.

11.0 REINITIATION OF CONSULTATION

This concludes formal consultation on the proposed federal MSB fishery as managed under the proposed Atlantic MSB FMP. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) a new species is listed or critical habitat designated that may be affected by the action; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered. In instances where the amount or extent of incidental take is exceeded, NMFS NERO must immediately request reinitiation of formal consultation on the MSB FMP.

12.0 LITERATURE CITED

Ackerman, R.A. 1997. The nest environment and embryonic development of sea turtles. Pages 83-106 in P.L. Lutz and J.A. Musick, eds. The Biology of Sea Turtles. New York: CRC Press.

Andrews, H.V., and K. Shanker. 2002. A significant population of leatherback turtles in the Indian Ocean. Kachhapa. 6:19.

Andrews, H.V., S. Krishnan, and P. Biswas. 2002. Leatherback nesting in the Andaman and Nicobar Islands. Kachhapa. 6:15-18.

ASMFC (Atlantic States Marine Fisheries Commission). 1999. Amendment 3 to the Interstate Fishery Management Plan for American Lobster. Atlantic States Marine Fisheries Commission. December 1997.

Atlantic States Marine Fisheries Commission (ASMFC). 2002. Amendment 4 to the Interstate Fishery Management Plan for weakfish. Fishery Management Report No. 39. Washington, D.C.: Atlantic States Marine Fisheries Commission.

Atlantic States Marine Fisheries Commission (ASMFC). 2004. Horseshoe crab 2004 stock assessment. Washington, D.C.: Atlantic States Marine Fisheries Commission.

Avens, L., J.C. Taylor, L.R. Goshe, T.T. Jones, and M. Hastings. 2009. Use of skeletochronological analysis to estimate the age of leatherback sea turtles *Dermochelys coriacea* in the western North Atlantic. Endangered Species Research 8:165-177.

Balazs, G.H. 1982. Growth rates of immature green turtles in the Hawaiian Archipelago. Pages 117-125 in K.A. Bjorndal, ed. Biology and conservation of sea turtles. Washington, D.C.: Smithsonian Institution Press.

Balazs, G.H. 1985. Impact of ocean debris on marine turtles: entanglement and ingestion. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-54:387-429.

Baldwin, R., G.R. Hughes, and R.T. Prince. 2003. Loggerhead turtles in the Indian Ocean. Pages 218-232 in A.B. Bolten and B.E. Witherington, eds. Loggerhead Sea Turtles. Washington, D.C.: Smithsonian Books.

Baker J.D., C.L. Littnan,D.W. Johnston. 2006. Potential effects of sea level rise on the terrestrial habitats of endangered and endemic megafauna in the Northwestern Hawaiian Islands. Endang Species Res 2:21-30.

Bjork, M., F.Short, E. McLeod, and S. Beers. 2008. Managing seagrasses for resilience to climate change. IUCN, Gland.

Bjorndal, K.A. 1985. Nutritional ecology of sea turtles. Copeia 1985:736-751.

Bjorndal, K.A. 1997. Foraging ecology and nutrition of sea turtles. Pages 199-233 In: Lutz, P.L. and J.A. Musick, eds., The Biology of Sea Turtles. CRC Press, New York. 432 pp.

Bjorndal, K.A., A.B. Bolten, and M.Y. Chaloupka. 2005. Evaluating trends in abundance of immature green turtles, *Chelonia mydas*, in the greater Caribbean. Ecol. Appl. 15(1):304-314.

Blumenthal, J.M., J.L. Solomon, C.D. Bell, T.J. Austin, G. Ebanks-Petrie, M.S. Coyne, A.C. Broderick, and B.J. Godley. 2006. Satellite tracking highlights the need for international cooperation in marine turtle management. Endangered Species Research 2:51-61.

Bolten, A.B., J.A. Wetherall, G.H. Balazs, and S.G. Pooley, compilers. 1996. Status of marine turtles in the Pacific Ocean relevant to incidental take in the Hawaii-based pelagic longline fishery. NOAA Technical Memorandum NMFS-SWFSC-230.

Bolten, A. 2003. The Biology of Sea Turtles, Vol II: Variation in Sea Turtle Life History Patterns: Neritic vs. Oceanic Developmental Stages. pp. 243-257.

Boulon, R.H., Jr. 2000. Trends in sea turtle strandings, U.S. Virgin Islands: 1982to 1997. pp.261-262. *In*: F.A. Abreu-Grobois, R. Briseño-Dueñas, R. Márquez-Millán, and L. Sarti-Martínez (compilers), Proccedings of the Eighteenth International Sea turtle Symposium. NOAA Technical Memorandum NMFS-SEFSC-436.

Bowen, B.W. 2003. What is a loggerhead turtle? The genetic perspective. Pages 7-27 in A.B. Bolten and B.E. Witherington, eds. Loggerhead Sea Turtles. Washington, D.C.: Smithsonian Press.

Bowen, B.W., A.L. Bass, L. Soares, and R.J. Toonen. 2005. Conservation implications of complex population structure: lessons from the loggerhead turtle (*Caretta caretta*). Molecular Ecology 14:2389-2402.

Bowen, B.W., and S.A. Karl. 2007. Population genetics and phylogeography of sea turtles. Molecular Ecology 16:4886-4907.

Braun, J., and S.P. Epperly. 1996. Aerial surveys for sea turtles in southern Georgia waters, June 1991. Gulf of Mexico Science 1996(1):39-44.

Braun-McNeill, J., and S.P. Epperly. 2004. Spatial and temporal distribution of sea turtles in the western North Atlantic and the U.S. Gulf of Mexico from Marine Recreational Fishery Statistics Survey (MRFSS). Marine Fisheries Review 64(4):50-56.

Burke, V.J., E.A. Standora, and S.J. Morreale. 1993. Diet of juvenile Kemp's ridley and loggerhead sea turtles from Long Island, New York. Copeia. 4:1176-1180

Burke, V.J., S.J. Morreale, and E.A. Standora. 1994. Diet of the Kemp's ridley sea turtle, *Lepidochelys kempii*, in New York waters. Fishery Bulletin. 92:26-32

Caillouet, C., C.T. Fontaine, S.A. Manzella-Tirpak, and T.D. Williams. 1995. Growth of head-started Kemp's ridley sea turtles (*Lepidochelys kempi*) following release. Chelonian Conservation and Biology 1(3):231-234.

Carr, A.R. 1963. Panspecific reproductive convergence in *Lepidochelys kempi*. Ergebnisse der Biologie 26:298-303.

Casale, P., P. Nicolosi, D. Freggi, M. Turchetto, and R. Argano. 2003. Leatherback turtles (*Dermochelys coriacea*) in Italy and in the Mediterranean basin. Herpetological Journal 13:135-139.

Castroviejo, J., J.B. Juste, J.P. Del Val, R. Castelo, and R. Gil. 1994. Diversity and status of sea turtle species in the Gulf of Guinea islands. Biodiversity and Conservation 3:828-836.

Cetacean and Turtle Assessment Program (CeTAP). 1982. Final report or the cetacean and turtle assessment program, University of Rhode Island, to Bureau of Land Management, U.S. Department of the Interior. Ref. No. AA551-CT8-48. 568 pp.

Chaloupka, M., and C. Limpus. 2001. Trends in the abundance of sea turtles resident in southern Great Barrier Reef waters. Biological Conservation 102:235-249.

Chan, E.H., and H.C. Liew. 1996. Decline of the leatherback population in Terengganu, Malaysia, 1956-1995. Chelonian Conservation and Biology 2(2):192-203.

Chevalier, J., X. Desbois, and M. Girondot. 1999. The reason for the decline of leatherback turtles *(Dermochelys coriacea)* in French Guiana: a hypothesis p.79-88. In Miaud, C. and R. Guyétant (eds.), Current Studies in Herpetology, Proceedings of the ninth ordinary general meeting of the Societas Europea Herpetologica, 25-29 August 1998 Le Bourget du Lac, France.

Church, *J.*, J.M. Gregory, P. Huybrechts, M. Kuhn, K. Lambeck, M.T. Nhlian, D. Qin, P.L. Woodworth. 2001. Changes in sea level. In: Houghton, J.T., Y. Ding, DJ. Griggs, M. Noguer, P.LVander Linden, X. Dai, K. Maskell, C.A. Johnson CA (eds.) Climate change 200 I: the scientific basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Ch

Clapham, P., S. Brault, H. Caswell, M. Fujiwara, S. Kraus, R. Pace and P. Wade. 2002. Report of the Working Group on Survival Estimation for North Atlantic Right Whales.

Cliffton, K., D.O. Cornejo, and R.S. Felger. 1982. Sea turtles of the Pacific coast of Mexico. Pages 199-209 in K.A. Bjorndal, ed. Biology and Conservation of Sea Turtles. Washington, D.C.: Smithsonian Institution Press.

Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009. 222 pp.

Davenport, J., and G.H. Balazs. 1991. 'Fiery bodies' – Are pyrosomas an important component of the diet of leatherback turtles? British Herpetological Society Bulletin 37:33-38.

Dodd, C.K. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service Biological Report 88(14):1-110.

Doughty, R.W. 1984. Sea turtles in Texas: a forgotten commerce. Southwestern Historical Quarterly 88:43-70.

Dutton, P.H., B.W. Bowen, D.W. Owens, A. Barragan, and S.K. Davis. 1999. Global phylogeography of the leatherback turtle (*Dermochelys coriacea*). Journal of Zoology 248:397-409.

Dutton, P.H., C. Hitipeuw, M. Zein, S.R. Benson, G. Petro, J. Pita, V. Rei, L. Ambio, and J. Bakarbessy. 2007. Status and genetic structure of nesting populations of leatherback turtles (*Dermochelys coriacea*) in the Western Pacific. Chelonian Conservation and Biology 6(1):47-53.

Dwyer, K.L., C.E. Ryder, and R. Prescott. 2002. Anthropogenic mortality of leatherback sea turtles in Massachusetts waters. Poster presentation for the 2002 Northeast Stranding Network Symposium.

Dwyer, K.L., C.E. Ryder, and R. Prescott. 2003. Anthropogenic mortality of leatherback sea turtles in Massachusetts waters. Page 260 in J.A. Seminoff, compiler. Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-503.

Eckert, S.A. 1999. Global distribution of juvenile leatherback turtles. Hubbs Sea World Research Institute Technical Report 99-294.

Eckert, S.A. and J. Lien. 1999. Recommendations for eliminating incidental capture and mortality of leatherback sea turtles, *Dermochelys coriacea*, by commercial fisheries in Trinidad and Tobago. A report to the Wider Caribbean Sea Turtle Conservation Network (WIDECAST). Hubbs-Sea World Research Institute Technical Report No. 2000-310, 7 pp.

Eckert, S.A., D. Bagley, S. Kubis, L. Ehrhart, C. Johnson, K. Stewart, and D. DeFreese. 2006. Internesting and postnesting movements of foraging habitats of leatherback sea turtles (*Dermochelys coriacea*) nesting in Florida. Chel. Cons. Biol. 5(2): 239-248.

Ehrhart, L.M., D.A. Bagley, and W.E. Redfoot. 2003. Loggerhead turtles in the Atlantic Ocean: geographic distribution, abundance, and population status. Pages 157-174 in A.B. Bolten and B.E. Witherington, eds. Loggerhead Sea Turtles. Washington, D.C.: Smithsonian Institution Press.

Ehrhart. L.M., W.E. Redfoot, and D.A. Bagley. 2007. Marine turtles of the central region of the Indian River Lagoon System, Florida. Florida Scientist 70(4):415-434.

Encyclopedia Britannica. 2010. Neritic Zone Defined. Retrieved January 29, 2010, from Encyclopedia Britannica Online: http://www.britannica.com/EBchecked/topic/409490/neritic-zone

Epperly, S.P., J. Braun, and A.J. Chester. 1995a. Aerial surveys for sea turtles in North Carolina inshore waters. Fishery Bulletin 93:254-261.

Epperly, S.P., J. Braun, A.J. Chester, F.A. Cross, J.V. Merriner, and P.A. Tester. 1995b. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. Bulletin of Marine Science 56(2):547-568.

Epperly, S.P., J. Braun, and A. Veishlow. 1995c. Sea turtles in North Carolina waters. Conservation Biology 9(2):384-394.

Epperly, S.P. and J. Braun-McNeill. 2002. The use of AVHRR imagery and the management of sea turtle interactions in the Mid-Atlantic Bight. National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, FL. 8pp.

Epperly, S.P., and W.G. Teas. 2002. Turtle Excluder Devices - Are the escape openings large enough? Fishery Bulletin 100:466-474.

Epperly, S., L. Avens, L. Garrison, T. Henwood, W. Hoggard, J. Mitchell, J. Nance, J. Poffenberger, C. Sasso, E. Scott-Denton, and C. Yeung. 2002. Analysis of sea turtle bycatch in the commercial shrimp fisheries of Southeast U.S. waters and the Gulf of Mexico. NOAA Technical Memorandum NMFS-SEFSC-490:1-88.

Epperly, S., L. Stokes, and S. Dick. 2004. Careful release protocols for sea turtle release with minimal injury. NOAA Technical Memorandum NMFS-SEFSC-524,42 pp.

Epperly, S.P., J. Braun-McNeill, and P.M. Richards. 2007. Trends in catch rates of sea turtles in North Carolina, USA. Endangered Species Research 3:283-293.

Ernst, C.H. and R.W. Barbour. 1972. Turtles of the United States. Univ. Press of Kentucky, Lexington. 347 pp.

Eyler, S., T. Meyer, S. Michaels, and B. Spear. 2007. Review of the fishery management plan in 2006 for horseshoe crab (*Limulus polyphemus*). Prepared by the ASMFC Horseshoe Crab Plan Review Team. 15pp.

Feely, R.A., C.L. Sabine, J.M. Hernandez-Ayon, D. Ianson, and B. Hales. 2008. Evidence for upwelling of corrosive "acidified" water onto the continental shelf. Science 320:1490-1492.

Ferreira, M.B., M. Garcia, B. Jupp, and A. Al-Kiyumi. 2003. Feeding ecology of the green turtle, Chelonia mydas, at Ra's Al Hadd, Arabian Sea, Sultanate of Oman. NOAA Tech. Mem. NOAA-TM-NMFSSEFSC-503:205–206.

Ferreira, B., M. Garcia, B.P. Jupp, and A. Al_Kiyumi. 2006. Diet of the green turtle (Chelonia mydas) at Ra's Al Hadd, Sultanate of Oman. Chelonian Conservation and Biology. 5(1): 141-146.

Florida Power and Light Company (FPL) and Quantum Resources, Inc. 2005. Florida Power andLight Company, St. Lucie Plant Annual Environmental Operating Report, 2002. 57 pages.

Fish, M.R., I.M. Cote, J.A Gill, AP. Jones, S. Renshoff, AR.Watkinson. 2005. Predicting the impact of sea-level rise on Caribbean sea turtle nesting habitat. Conserv Biol 19: 482-491. ange. Cambridge U

Franklin IR. 1980. Evolutionary change in small populations. In: Soule ME, Wilcox BA, editors. Conservation Biology: An Evolutionary-Ecological perspective. Sunderland (MA): Sinauer;p.135-150.

Frazer, N. B. and L. M. Ehrhart. 1985. Preliminary growth models for green, *Chelonia mydas*, and loggerhead, *Caretta caretta*, turtles in the wild. Copeia 1985(1):73-79.

Fritts, T.H. 1982. Plastic bags in the intestinal tracts of leatherback marine turtles. Herpetological Review 13(3): 72-73.

Gagosian, R.B. 2003. Abrupt climate change: should we be worried? Prepared for a panel on abrupt climate change at the World Economic Forum, Davos, Switzerland, January 27, 2003. 9pp.

Garner, J.A., and S.A. Garner. 2007. Tagging and nesting research on leatherback sea turtles (*Dermochelys coriacea*) on Sandy Point, St. Croix, U.S. Virgin Islands, 2007. Annual Report of the Virgin Islands Department of Planning and Natural Resources, Division of Fish and Wildlife. 48pp.

Garrison, L.P., L. Stokes, and C. Fairfield. 2009. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2008. NOAA Technical Memorandum NMFS-SEFSC-591:1-58.

George, R.H. 1997. Health problems and diseases of sea turtles. In: P.L. Lutz & J.A. Musick (Eds). The biology of sea turtles. CRC Press, Boca Raton, Florida. pp. 363-385.

Girondot, M. and J. Fretey. 1996. Leatherback turtles, *Dermochelys coriacea,* nesting in French Guiana 1978-1995. Chelonian Conserv Biol 2: 204-208.

Girondot, M., M.H. Godfrey, L. Ponge, and P. Rivalan. 2007. Modeling approaches to quantify leatherback nesting trends in French Guiana and Suriname. Chelonian Conservation and Biology 6(1):37-46.

Glass, A. H., T. V. N. Cole, M. Garron, R. L. Merrick, and R. M. Pace III. 2008. Mortality and Serious Injury Determinations for Baleen Whale Stocks Along the United States Eastern Seaboard and Adjacent Canadian Maritimes, 2002-2006. Northeast Fisheries Science Center Document 08-04; 18 pp.

Glen, F., A.C. Broderick, B.J. Godley, and G.C. Hays. 2003. Incubation environment affects phenotype of naturally incubated green turtle hatchlings. Journal of the Marine Biological Association of the United Kingdom 83(5):1183-1186.

GMFMC (Gulf of Mexico Fishery Management Counsil). 2007. Amendment 27 To The Reef Fish Fishery Management Plan and Amendment 14 To The Shrimp Fishery Management Plan with a Supplemental Environmental Impact Statement, Regulatory Impact Review, and Regulatory Flexibility Act Analysis. Gulf of Mexico Fishery Management Council. June 2007.

Goff, G.P. and J.Lien. 1988. Atlantic leatherback turtle, *Dermochelys coriacea*, in cold water off Newfoundland and Labrador. Can. Field Nat.102(1):1-5.

Goldenberg, S B., C.W. Landsea, AM. Mestas-Nunez, W.M. Gray. 2001. The recent increase in Atlantic hurricane activity: causes and implications. Science 293:474-479

Graff, D. 1995. Nesting and hunting survey of the turtles of the island of S□o Tomé. Progress Report July 1995, ECOFAC Componente de S□o Tomé e Príncipe, 33 pp.

Hamann, M., C.J. Limpus, and M.A Read. 2007. Chapter 15 Vulnerability ofmarine reptiles in the Great B'arrier Reef to climate change. *In:* Johnson JE, Marshall PA (eds) Climate change and the Great Barrier Reef: a vulnerability assessment, Great Barrier Reef Marine Park Authorlty and Australia Greenhouse Office, Hobart, p 465--496.

Hatase, H., M. Kinoshita, T. Bando, N. Kamezaki, K. Sato, Y. Matsuzawa, K. Goto, K. Omuta, Y. Nakashima, H. Takeshita, and W. Sakamoto. 2002. Population structure of loggerhead turtles, *Caretta caretta*, nesting in Japan: Bottlenecks on the Pacific population. Marine Biology 141:299-305.

Hawkes, L.A., A.C. Broderick, M.H. Godfrey, and B.J. Godley. 2005. Status of nesting loggerhead turtles *Caretta caretta* at Bald head Island (North Carolina, USA) after 24 years of intensive monitoring and conservation. Oryx 39(1):65-72.

Hawkes, L.A., A.C. Broderick, M.H. Godfrey, and B.J. Godley. 2007. Investigating the potential impacts of climate change on a marine turtle population. Global Change Biology 13:1-10.

Hawkes, L.A, AC. Broderick, M.H. Godfrey, and BJ. Godley.· 2009. Climate change and marine turtles. Endangered Species Research 7: 137-159.

Hawkes, L.A., A.C. Broderick, M.S. Coyne, M.H. Godfrey, L.-F. Lopez-Jurado, P. Lopez-Suarez, S.E. Merino, N. Varo-Cruz, and B.J. Godley. 2006. Phenotypically linked dichotomy in sea turtle foraging requires multiple conservation approaches. Current Biology 16: 990-995.

Hays, G.C., A.C. Broderick, F. Glen, B.J. Godley, J.D.R. Houghton, and J.D. Metcalfe. 2002. Water temperature and internesting intervals for loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles. Journal of Thermal Biology 27:429-432.

Henwood, T.A., and W. Stuntz. 1987. Analysis of sea turtle captures and mortalities during commercial shrimp trawling. Fish. Bull., U.S. 85(4):813-817.

Hilterman, M.L. and E. Goverse. 2004. Annual report of the 2003 leatherback turtle research and monitoring project in Suriname. World Wildlife Fund - Guianas Forests and Environmental Conservation Project (WWF-GFECP) Technical Report of the Netherlands Committee for IUCN (NC-IUCN), Amsterdam, the Netherlands, 21p.

Hirth, H.F. 1971. Synopsis of biological data on the green sea turtle, Chelonia mydas. FAO Fisheries Synopsis 85:1-77.

Hirth, H.F. 1997. Synopsis of the biological data of the green turtle, *Chelonia mydas* (Linnaeus 1758). USFWS Biological Report 97(1):1-120.

International Council for the Exploration of the Sea (ICES). 2005. Study Group on the Bycatch of Salmon in Pelagic Trawl Fisheries (SGBYSAL). ICES

CM 2005 (ACFM:13), 41 pp.

International Council for the Exploration of the Sea (ICES). 2006. Report of the Working Group on North Atlantic Salmon (WGNAS). ICES CM 2006 (ACFM:23), 254 pp.

Intergovernmental Panel on Climate Change (IPCC). 2007. Summary for Policymakers. Cambridge University Press, Cambridge.

International Union for Conservation of Nature (IUCN). 2008. IUCN Red List of threatened species: 2001 categories & criteria (version 3.1) http://www.iucnredlist.org/info/categories_criteria2001

James, M.C., R.A. Myers, and C.A. Ottenmeyer. 2005a. Behaviour of leatherback sea turtles, *Dermochelys coriacea*, during the migratory cycle. Proc. R. Soc. B, 272: 1547-1555.

James, M.C., C.A. Ottensmeyer, and R.A. Myers. 2005b. Identification of high-use habitat and threats to leatherback sea turtles in northern waters: new directions for conservation. Ecol. Lett. 8:195-201.

Johnson, A, G. Salvador, J. Kenney, J. Robbins, S. Kraus, S. Landry, and P. Clapham. 2005. Fishing gear involved in entanglements of right and humpback whales. Marine Mammal Science. 21(4):635–645.

Jones A.R., W. Gladstone, N.J. Hacking. 2007. Australian sandy beach ecosystems and climate change: ecology and management. Aust Zool 34: 190-202

Kasparek, M., B.J. Godley, and A.C. Broderick. 2001. Nesting of the green turtle, *Chelonia mydas*, in the Mediterranean: a review of status and conservation needs. Zoology in the Middle East 24:45-74.

Kelle,L., N. Gratiot, I. Nolibos,J. Therese, R. Wongsopawiro, and B.DeThoisy. 2007. Monitoring of nesting leatherback turtles *(Dermochelys coriacea):* contribution of remotesensing for real time assessmentofbeach coverage in French Guiana.. Chelonian Conserv Biol 6: 142-149.

Keinath, J.A., J.A. Musick, and R.A. Byles. 1987. Aspects of the biology of Virginias sea turtles: 1979-1986. Virginia J. Sci. 38(4): 329-336.

Kuller, Z. 1999. Current status and conservation of marine turtles on the Mediterranean coast of Israel. Marine Turtle Newsletter 86:3-5.

Lacroix, G.L. and D. Knox. 2005. Distribution of Atlantic salmon (*Salmo salar*) postsmolts of different origins in the Bay of Fundy and Gulf of Maine and evaluation of factors affecting migration, growth, and survival. Can. J. Fish. Aquat. Sci. 62: 1363–1376.

Lageux, C.J., C. Campbell, L.H. Herbst, A.R. Knowlton and B. Weigle. 1998. Demography of marine turtles harvested by Miskitu Indians of Atlantic Nicaragua. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-412:90.

Lalli, C.M. and T.R. Parsons. 1997. Biological oceanography: An introduction – 2nd Edition. Pages 1-13. Butterworth-Heinemann Publications. 335 pp.

Laurent, L., P. Casale, M.N. Bradai, B.J. Godley, G. Gerosa, A.C. Broderick, W. Schroth, B. Schierwater, A.M. Levy, D. Freggi, E.M. Abd El-Mawla, D.A. Hadoud, H.E. Gomati, M. Domingo, M. Hadjichristophorou, L. Kornaraki, F. Demirayak, and C. Gautier. 1998. Molecular resolution of the marine turtle stock composition in fishery bycatch: A case study in the Mediterranean. Molecular Ecology 7:1529-1542.

Lewison, R.L., L.B. Crowder, and D.J. Shaver. 2003. The impact of turtle excluder devices and fisheries closures on loggerhead and Kemp's ridley strandings in the western Gulf of Mexico. Conservation Biology 17(4):1089-1097.

Lewison, R.L., S.A. Freeman, and L.B. Crowder. 2004. Quantifying the effects of fisheries on threatened species: the impact of pelagic longlines on loggerhead and leatherback sea turtles. Ecology Letters 7: 221-231.

Limpus, C.J. and D.J. Limpus. 2000. Mangroves iIi. the diet of *Chelonia mydas* in Queensland, Australia. Mar Turtle Newsl89: 13-15.

Limpus, C.J., and D.J. Limpus. 2003. Loggerhead turtles in the equatorial Pacific and southern Pacific Ocean: a species in decline. Pages 93-113 in A.B. Bolten and B.E. Witherington, eds. Loggerhead Sea Turtles. Washington, D.C.: Smithsonian Institution.

Lutcavage, M. and J.A. Musick. 1985. Aspects of the biology of sea turtles in Virginia. Copeia. 2:449-456

Lutcavage, M.E., and P.L. Lutz. 1997. Diving physiology. Pages 277-296 in P.L. Lutz and J.A. Musick, eds. The Biology of Sea Turtles. Boca Raton, Florida: CRC Press.

Lutcavage, M.E., P. Plotkin, B. Witherington, and P.L. Lutz. 1997. Human impacts on sea turtle survival. Pages 387-409 in P.L. Lutz and J.A. Musick, eds. The Biology of Sea Turtles. Boca Raton, Florida: CRC Press.

MacLeod, C.D. 2009. Global climate change, range changes and potential implications for the conservation of marine cetaceans: a review and synthesis. Endang Species Res 7, 125-136.

Magnuson, J.J., K.A. Bjorndal, W.D. DuPaul, G.L. Graham, D.W. Owens, P.C.H. Pritchard, J.I. Richardson, G.E. Saul, and C.W. West. 1990. Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C. 274 pp.

Maier, P.P., A.L. Segars, M.D. Arendt, and J.D. Whitaker. 2005. Examination of local movement and migratory behavior of sea turtles during spring and summer along the Atlantic coast off the southeastern United States. Annual report for grant number NA03NMF4720281. 29pp.

Maier, P.P., A.L. Segars, M.D. Arendt, J.D. Whitaker, B.W. Stender, L. Parker, R. Vendetti, D.W. Owens, J. Quattro, and S.R. Murphy. 2004. Development of an index of sea turtle abundance based on in-water sampling with trawl gear. Final report to the National Marine Fisheries Service. 86 pp.

Mansfield, K. L. 2006. Sources of mortality, movements, and behavior of sea turtles in Virginia. Ph.D. dissertation, College of William and Mary. 343 pp.

Mansfield, K.L., J.A. Musick, and R.A. Pemberton. 2001. Characterization of the Chesapeake Bay pound net and whelk pot fisheries and their potential interactions with marine sea turtle species. Final Report to the National Marine Fisheries Service under Contract No. 43EANFO30131. 75 pp.

Marcano, L.A. and J.J. Alio-M. 2000. Incidental capture of sea turtles by the industrial shrimping fleet off northwestern Venezuela. U.S. department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-436:107.

Marcovaldi, M.A., and M. Chaloupka. 2007. Conservation status of the loggerhead sea turtle in Brazil: an encouraging outlook. Endangered Species Research 3:133-143.

Margaritoulis, D., R. Argano, I. Baran, F. Bentivegna, M.N. Bradai, J.A. Camiñas, P. Casale, G. De Metrio, A. Demetropoulos, G. Gerosa, B.J. Godley, D.A. Haddoud, J. Houghton, L. Laurent, and B. Lazar. 2003. Loggerhead turtles in the Mediterranean Sea: present knowledge and conservation perspectives. Pages 175-198 in A.B. Bolten and B.E. Witherington, eds. Loggerhead Sea Turtles. Washington, D.C.: Smithsonian Institution.

Martin, R.E. 1996. Storm impacts on loggerhead turtle reproductive success. Mar Turtle Newsl 73:10-12.

Márquez, R. 1990. FAO Species Catalogue, Vol. 11. Sea turtles of the world, an annotated and illustrated catalogue of sea turtle species known to date. FAO Fisheries Synopsis, 125:1-81.

Mazaris AD., G. Mastinos, J.D. Pantis. 2009. Evaluating the impacts of coastal squeeze on sea· turtle nesting. Ocean Coast Manag 52:139-145.

McClellan, C.M., and A.J. Read. 2007. Complexity and variation in loggerhead sea turtle life history. Biology Letters 3:592-594.

Merrick, R. and H. Haas. 2008. Analysis of Atlantic sea scallop (*Placopecten magellanicus*) fishery impacts on the North Atlantic population of loggerhead sea turtles (*Caretta caretta*).

U.S. Dep. Commer., Northeast Fish. Sci. Center. NOAA Tech. Memo. NMFS-NE-207, 22pp.

Meylan, A. 1982. Estimation of population size in sea turtles. Pages 135-138 in K.A. Bjorndal, ed. Biology and Conservation of Sea Turtles. Washington, D.C.: Smithsonian Institution Press.

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the state of Florida. Florida Marine Research Publication 52:1-51.

Meylan, A., B.E. Witherington, B. Brost, R. Rivero, and P.S. Kubilis. 2006. Sea turtle nesting in Florida, USA: Assessments of abundance and trends for regionally significant populations of *Caretta*, *Chelonia*, and *Dermochelys*. Pages 306-307 in M. Frick, A. Panagopoulou, A. Rees, and K. Williams, compilers. Twenty-sixth Annual Symposium on Sea Turtle Biology and Conservation, Book of Abstracts.

Mid-Atlantic Fishery Management Council (MAFMC). 2007a. 2008 Atlantic mackerel, squid, and butterfish specifications, including an Environmental Assessment, Regulatory Impact Review, and Initial Flexibility Analysis. Mid-Atlantic Fishery Management Council. November 2007.

Mid-Atlantic Fishery Management Council (MAFMC). 2007b. 2008 Summer flounder, scup, and black sea bass specifications including an Environmental Assessment, Regulatory Impact Review, Initial Regulatory Flexibility Analysis and Essential Fish Habitat Assessment. Mid-Atlantic Fishery Management Council. November 2007.

Mid-Atlantic Fishery Management Council (MAFMC) and Atlantic States Marine Fisheries Commission (ASMFC). 1998. Amendment 1 to the Bluefish Fishery Management Plan with a Supplemental Environmental Impact Statement and Regulatory Impact Review. Mid-Atlantic Fishery Management Council. October 1998.

Mitchell, G.H., R.D. Kenney, A.M. Farak, and R.J. Campbell. 2003. Evaluation of occurrence of endangered and threatened marine species in naval ship trial areas and transit lanes in the Gulf of Maine and offshore of Georges Bank. NUWC-NPT Technical Memo 02-121A. March 2003. 113 pp.

Moore M.J., A.R., Knowlton, S.D. Kraus, W.A. McLellan, R.K. Bonde. 2004. Morphometry, gross morphology and available histopathology in North Atlantic right whale (*Eubalaena glacialis*) mortalities (1970–2002). Journal of Cetacean Research and Management. 6(3):199-214.

Morreale, S.J. and E.A. Standora. 1990. Occurrence, movement and behavior of the Kemp's ridley and other sea turtles in New York waters. Okeanos Ocean Research Foundation annual report to the New York State Department of Environmental Conservation, April 1989-April 1990. Return a Gift to Wildlife Contract # C001984.

Morreale, S.J., and E.A. Standora. 1993. Occurrence, movement, and behavior of the Kemp's ridley and other sea turtles in New York waters. Okeanos Ocean Research Foundation Final Report April 1988-March 1993. 70 pp.

Morreale, S.J., and E.A. Standora. 1998. Early life stage ecology of sea turtles in northeastern U.S. waters. NOAA Technical Memorandum NMFS-SEFSC-413:1-49.

Morreale, S.J. and E.A. Standora. 2005. Western North Atlantic waters: Crucial developmental habitat for Kemp's ridley and loggerhead sea turtles. Chel. Conserv. Biol. 4(4):872-882.

Morreale, S.J., C.F. Smith, K. Durham, R.A. DiGiovanni, Jr., and A.A. Aguirre. 2005. Assessing health, status, and trends in northeastern sea turtle populations. Interim report - Sept. 2002 - Nov. 2004. Gloucester, Massachusetts: National Marine Fisheries Service.

Mortimer, J.A. 1982. Feeding ecology of sea turtles. pp. 103-109. *In*: K.A. Bjorndal (ed.), Biology and conservation of sea turtles. Smithsonian Institution Press, Washington D.C.

Mrosovsky, N. 1981. Plastic jellyfish. Marine Turtle Newsletter 17:5-6.

Murphy, T.M., S.R. Murphy, D.B. Griffin, and C. P. Hope. 2006. Recent occurrence, spatial distribution and temporal variability of leatherback turtles (*Dermochelys coriacea*) in nearshore waters of South Carolina, USA. Chel. Cons. Biol. 5(2): 216-224.

Murphy, T.M., and S.R. Hopkins. 1984. Aerial and ground surveys of marine turtle nesting beaches in the southeast region. Final Report to the National Marine Fisheries Service. 73pp.

Murray, K.T. 2004. Bycatch of sea turtles in the Mid-Atlantic sea scallop (*Placopecten magellanicus*) dredge fishery during 2003. NEFSC Reference Document 04-11; 25 pp.

Murray, K.T. 2006. Estimated average annual bycatch of loggerhead sea turtles *(Caretta caretta)* in U.S. Mid-Atlantic bottom otter trawl gear, 1996-2004. U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 06-19, 26pp.

Murray, K.T. 2007. Estimated bycatch of loggerhead sea turtles (*Caretta caretta*) in U.S. Mid-Atlantic scallop trawl gear, 2004-2005, and in sea scallop dredge gear, 2005. NEFSC Reference Document 07-04; 30 pp.

Murray, K.T. 2008. Estimated average annual bycatch of loggerhead sea turtles (*Caretta caretta*) in U.S. Mid-Atlantic bottom otter trawl gear, 1996-2004 (2nd edition). NEFSC Reference Document 08-20; 32 pp.

Murray, K.T. 2009a. Characteristics and magnitude of sea turtle bycatch in US mid-Atlantic gillnet gear. Endangered Species Research 8:211-224.

Murray, K.T. 2009b. Proration of estimated bycatch of loggerhead sea turtles in U.S. Mid-Atlantic sink gillnet gear to vessel trip report catch, 2002-2006. NEFSC Reference Document 09-19; 7 pp.

Musick, J.A., and C.J. Limpus. 1997. Habitat utilization and migration in juvenile sea turtles. Pages 137-164 in P.L. Lutz and J.A. Musick, eds. The Biology of Sea Turtles. Boca Raton, Florida: CRC Press.

National Marine Fisheries Service (NMFS). 1995. Endangered Species Act Section 7 consultation on United States Coast Guard vessel and aircraft activities along the Atlantic coast. Biological Opinion. September 15, 1995.

National Marine Fisheries Service (NMFS). 1996. Endangered Species Act Section 7 Consultation on the proposed shock testing of the SEAWOLF submarine off the Atlantic Coast of Florida during the summer of 1997. Biological Opinion. December 12, 1996.

National Marine Fisheries Service (NMFS). 1997. Endangered Species Act Section 7 consultation on Navy activities off the southeastern United States along the Atlantic Coast. Biological Opinion. May 15, 1997.

National Marine Fisheries Service (NMFS). 1998a. Final recovery plan for the shortnose sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. October 1998.

National Marine Fisheries Service (NMFS). 1998c. Second reinitiation of Endangered Species Act Section 7 consultation on United States Coast Guard vessel and aircraft activities along the Atlantic coast. Biological Opinion. June 8, 1998b.

National Marine Fisheries Service (NMFS). 1999. Endangered Species Act Section 7 Consultation on the Fishery Management Plan for the Atlantic Bluefish Fishery and Amendment 1 to the Fishery Management Plan. July 12.

National Marine Fisheries Service (NMFS). 2001a. Biological Opinion. Authorization of fisheries under the Northeast Multispecies Fishery Management Plan. June 14, 2001.

National Marine Fisheries Service (NMFS). 2001b. Biological Opinion. Authorization of fisheries under the Spiny Dogfish Fishery Management Plan. June 14, 2001.

National Marine Fisheries Service (NMFS). 2001c. Biological Opinion. Authorization of fisheries under the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan. December 16, 2001.

National Marine Fisheries Service (NMFS). 2001d. Biological Opinion. NMFS' approval of the Tilefish Fishery Management Plan June 14, 2001.

National Marine Fisheries Service (NMFS). 2002a. Endangered Species Act Section 7 Consultation on Shrimp Trawling in the Southeastern United States, under the Sea Turtle Conservation Regulations and as Managed by the Fishery Management Plans for Shrimp in the South Atlantic and Gulf of Mexico. Biological Opinion. December 2, 2002.

National Marine Fisheries Service (NMFS). 2002b. Biological Opinion. Reinitiation of Consultation on Federal Lobster Management in the Exclusive Economic Zone for Implementation of Historical Participation. October 31, 2002.

National Marine Fisheries Service (NMFS). 2002c. Biological Opinion. Implementation of the Deep-Sea Red Crab, *Chaceon quinquedens*, Fishery Management Plan. February 6, 2002.

National Marine Fisheries Service (NMFS). 2003. Essential fish habitat consultation on Amendment 13 of the Northeast Multispecies Fishery Management Plan. Memorandum to the file. December 19, 2003.

National Marine Fisheries Service (NMFS). 2004a. Endangered Species Act Section 7 Reinitiated Consultation on the Continued Authorization of the Atlantic Pelagic Longline Fishery under the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (HMS FMP). Biological Opinion. June 1, 2004.

National Marine Fisheries Service (NMFS). 2004b. Endangered Species Act Section 7 Consultation on the Proposed Regulatory Amendments to the Fisheries Management Plan for the Pelagic Fisheries of the Western Pacific. Biological Opinion. February 23, 2004.

National Marine Fisheries Service (NMFS). 2005b. Endangered Species Act Section 7 Consultation on the Continued Authorization of the Hawaii-based Pelagic, Deep-Set, Tuna Longline Fishery based on the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region. Biological Opinion, October 4.

National Marine Fisheries Service (NMFS). 2006b. Endangered Species Act Section 7 Consultation on the United States Navy Sinking Exercises (SINKEX) in the Western North Atlantic Ocean. Biological Opinion, September 22.

National Marine Fisheries Service (NMFS). 2007a. Final Environmental Impact Statement for amending the Atlantic Large Whale Take Reduction Plan: broad-based gear modifications. Volume I of II.

National Marine Fisheries Service (NMFS). 2007b. Endangered Species Act Section 7 consultation on the Northeast Fisheries Science Center Research Vessel Activities. Biological Opinion. August 20, 2007.

National Marine Fisheries Service (NMFS). 2008a. Summary Report of the Workshop on Interactions Between Sea Turtles and Vertical Lines in Fixed-Gear Fisheries. M.L. Schwartz (ed.), Rhode Island Sea Grant, Narragansett, Rhode Island. 54 pp.

National Marine Fisheries Service (NMFS). 2008b. Endangered Species Act Section 7 Consultation on the Atlantic Sea Scallop Fishery Management Plan. Biological Opinion. March 14, 2008.

National Marine Fisheries Service (NMFS). 2008c. Endangered Species Act Section 7 Consultation on the U.S. Navy Atlantic Fleet's conduct of active sonar training along the Atlantic Coast of the United States and in the Gulf of Mexico from January 2009 to January 2014. Biological Opinion. January 16, 2008.

National Marine Fisheries Service (NMFS). 2008d. Summary Report of the Workshop on Interactions Between Sea Turtles and Vertical Lines in Fixed-Gear Fisheries. M.L. Schwartz (ed.), Rhode Island Sea Grant, Narragansett, R.I. 54pp.

National Marine Fisheries Service (NMFS). 2009a. Endangered Species Act Section 7 Consultation on the U.S. Navy Atlantic Fleet's conduct of active sonar training along the Atlantic Coast of the United States and in the Gulf of Mexico from January 2009 to January 2010. Biological Opinion. January 21, 2009.

National Marine Fisheries Service (NMFS). 2009b. Endangered Species Act Section 7 Consultation on U.S. Navy activities in the Virginia Capes, Cherry Point, and Jacksonville Range Complexes from June 2009 to June 2010. Biological Opinion. June 5, 2009.

National Marine Fisheries Service (NMFS). 2009c. Endangered Species Act Section 7 Consultation on the Atlantic Sea Scallop Fishery Management Plan. Biological Opinion. February 5, 2009.

National Marine Fisheries Service (NMFS). 2010. Draft Environmental Impact Statement for Proposed Effort Control Measures for the American Lobster Fishery. Received March 03, 2010.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1991. Recovery plan for U.S. population of Atlantic green turtle *Chelonia mydas*. Washington, D.C.: National Marine Fisheries Service. 58 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1992. Recovery plan for the Kemp's ridley sea turtle. National Marine Fisheries Service, Washington, D.C. 40 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1992. Recovery plan for leatherback turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. National Marine Fisheries Service, Silver Spring, Maryland. 139 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1998a. Recovery Plan for the U.S. Pacific Population of the Loggerhead Turtle (*Caretta caretta*). National Marine Fisheries Service, Silver Spring, Maryland.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1998b. Recovery Plan for the U.S. Pacific Population of the Leatherback Turtle (*Dermochelys coriacea*). National Marine Fisheries Service, Silver Spring, Maryland.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1998c. Recovery Plan for U.S. Pacific Populations of the Green Turtle (*Chelonia mydas*). Silver Spring, Maryland: National Marine Fisheries Service. 84 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007a. Loggerhead sea turtle (*Caretta caretta*) 5 year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland. 65 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007b. Leatherback sea turtle (*Dermochelys coriacea*) 5 year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland. 79 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007c. Kemp's ridley sea turtle *(Lepidochelys kempii*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 50 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007d. Green sea turtle (*Chelonia mydas*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 102 pp.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2008. Recovery plan for the Northwest Atlantic population of the loggerhead turtle (*Caretta caretta*), Second revision. Washington, D.C.: National Marine Fisheries Service. 325 pp.

National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC). 2003. Report of the 37th Northeast Regional Stock Assessment Workshop (37th SAW): Stock Assessment Review Committee (SARC) consensus summary of assessments. Northeast Fish. Sci. Cent. Ref. Doc. 03-16; 597 p.

National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC). 2005. 40th Northeast Regional Stock Assessmennt Workshop (40th SAW) Assessment Report. Northeast Fish. Sci. Cent. Ref. Doc. 05-04.

National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC). 2006. 43rd Northeast Regional Stock Assessment Workshop (43rd SAW): 43rd SAW assessment report. US Dep Commer, Northeast Fish Sci Cent Ref Doc 06-25; 400 p.

National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC). 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-455. 343 pp.

National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC). 2008. Careful release protocols for sea turtle release with minimal injury. NOAA Technical Memorandum NMFS-SEFSC-580, 130 pp.

National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC). 2009. An assessment of loggerhead sea turtles to estimate impacts of mortality reductions on population dynamics. NMFS SEFSC Contribution PRD-08/09-14. 45 pp.

National Research Council (NRC). 1990. Decline of seat turtles: causes and prevention. National Academy Press, Washington D.C. 259 pages.

New England Fishery Management Council (NEFMC). 1982. Fishery Management Plan, Final Environmental Impact Statement, Regulatory Impact Review for Atlantic sea scallops (*Placopecten magellanicus*). Prepared by the New England Fishery Management Council in consultation with Mid-Atlantic Fishery Management Council and South Atlantic Fishery Management Council. January 1982.

New England Fishery Management Council (NEFMC). 2003. Final Amendment 10 to the Atlantic Sea Scallop Fishery Management Plan with a Supplemental Environmental Impact Statement, Regulatory Impact Review, and Regulatory Flexibility Analysis. New England Fishery Management Council. November 2003.

New England Fishery Management Council (NEFMC). 2006. Final Amendment 1 to the Fishery Management Plan for Atlantic Herring. Final Supplemental Environmental Impact Statement, Initial Regulatory Flexibility Analysis. New England Fishery Management Council. May 2006.

New England Fishery Management Council (NEFMC). 2007. Final Amendment 11 to the Atlantic Sea Scallop Fishery Management Plan (FMP) including a Final Supplemental Environmental Impact Statement (FSEIS) and Initial Regulatory Flexibility Analysis (IRFA). Prepared by the New England Fishery Management Council in consultation with the National Marine Fisheries Service and the Mid-Atlantic Fishery Management Council. September 2007.

National Oceanic and Atmospheric Administration (NOAA). 2008. High numbers of right whales seen in Gulf of Maine: NOAA researchers identify wintering ground and potential breeding ground. NOAA press release; December 31, 2008.

Northeast Data Poor Stocks Working Group. 2007. Monkfish assessment summary for 2007. US Dept Commer, *Northeast Fish Sci Cent Ref Doc.* 07-13; 12 p.

Northeast Region Essential Fish Habitat Steering Committee (NREFHSC). 2002. Workshop on the effects of fishing gear on marine habitat off the northeastern United States. October 23-25, Boston, Massachusetts. Northeast Fish. Sci. Center Ref. Doc. 02-01, 86pp.

NRC (National Research Council). 1990. Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C.

Nicholls, RJ. 1998. Coastal vulnerability assessment for sea level rise: evaluation arid selection of methodologies for implementation. Technical Report R098002, Caribbean Planning for Adaptionto Global Climate Change (CPACC) Project. Available at: www.cpacc.org.

Palka, D. 2000. Abundance and distribution of sea turtles estimated from data collected during cetacean surveys. Pages 71-72 in K.A. Bjorndal and A.B. Bolten, eds. Proceedings of a workshop on assessing abundance and trends for in-water sea turtle populations. NOAA Technical Memorandum NMFS-SEFSC-445.

Pearce, A.F. 2001. Contrasting population structure of the loggerhead turtle (*Caretta caretta*) using mitochondrial and nuclear DNA markers. Master's thesis, University of Florida. 71 pp.

Pearce, A.F. and B.W. Bowen. 2001. Final report: Identification of loggerhead (*Caretta caretta*) stock structure in the southeastern United States and adjacent regions using nuclear DNA markers. Project number T-99-SEC-04. Submitted to the National Marine Fisheries Service, May 7, 2001. 79 pp.

Pike, D.A., R.L. Antworth, and J.C. Stiner. 2006. Earlier nesting contributes to shorter nesting seasons for the loggerhead sea turtle, *Caretta caretta*. Journal of Herpetology 40(1):91-94.

Pike, D.A and J.C. Stiner. 2007. Sea turtle species vary in their susceptibility to tropical cyclones. Oecologia 153:.471-478.

Plaziat, J.c., and P.G.E.F. Augustinius. 2004. Evolution of progradation/ erosion along the French Guiana magrove coast: a comparison of mapped shorelines since the 18th century with Holocene data. Mar Geo1208: 127-143.

Pritchard, P.C.H. 1982. Nesting of the leatherback turtle, *Dermochelys coriacea*, in Pacific, Mexico, with a new estimate of the world population status. Copeia 1982:741-747.

Pritchard, P.C.H. 2002. Global status of sea turtles: An overview. Document INF-001 prepared for the Inter-American Convention for the Protection and Conservation of Sea Turtles, First Conference of the Parties (COP1IAC), First part August 6-8, 2002.

Prusty, G., S. Dash, and M.P. Singh. 2007. Spatio-temponll analysis of multi-date IRS imageries for turtle habitat dynamics characterisation at Gahirmatha coast, India. Int J Remote Sens 28: 871-883

Rahmstorf, S. 1997. Risk of sea-change in the Atlantic. Nature 388: 825-826.

Rahmstorf, S. 1999. Shifting seas in the greenhouse? Nature 399: 523-524.

Rebel, T.P. 1974. Sea turtles and the turtle industry of the West Indies, Florida and the Gulf of Mexico. Univ. Miami Press, Coral Gables, Florida.

Rees, A.F., A. Saad, and M. Jony. 2005. Marine turtle nesting survey, Syria 2004: discovery of a "major" green turtle nesting area. Page 38 in Book of Abstracts of the Second Mediterranean Conference on Marine Turtles. Antalya, Turkey, 4-7 May 2005.

Reilly, S.B., Bannister, J.L., Best, P.B., Brown, M., Brownell Jr., R.L., Butterworth, D.S., Clapham, P.J., Cooke, J., Donovan, G.P., Urbán, J. & Zerbini, A.N. 2008. *Eubalaena glacialis*. In: IUCN 2009. IUCN Red List of Threatened Species. Version 2009.2. <www.iucnredlist.org>.

Rivalan, P., P.H. Dutton, E. Baudry, S.E. Roden; and M. Girondot. 2005. Demographic scenario inferred from genetic data in leatherback turtles nesting in French.Guiana and Suriname. Biol Conserv 1: 1-9.

Ross, J.P. 1996. Caution urged in the interpretation of trends at nesting beaches. Marine Turtle Newsletter 74:9-10.

Ross. J.P.· 2005. Hurricane effects on nesting *Caretta caretta.* Mar Turtle Newsl108:13-14.

Ruben, H.J., and S.J. Morreale. 1999. Draft Biological Assessment for sea turtles in the New York and New Jersey Harbor Complex. Prepared for the National Marine Fisheries Service.

Sarti, L., S.A. Eckert, N. Garcia, and A.R. Barragan. 1996. Decline of the world's largest nesting assemblage of leatherback turtles. Marine Turtle Newsletter 74:2-5.

Sarti, L., S. Eckert, P. Dutton, A. Barragán, and N. García. 2000. The current situation of the leatherback population on the Pacific coast of Mexico and central America, abundance and distribution of the nestings: an update. Pages 85-87 in H. Kalb and T. Wibbels, compilers. Proceedings of the Nineteenth Annual Symposium on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFSC-443.

Sarti Martinez, L., A.R. Barragan, D.G. Munoz, N. Garcia, P. Huerta, and F. Vargas. 2007. Conservation and biology of the leatherback turtle in the Mexican Pacific. Chelonian Conservation and Biology 6(1):70-78.

Sasso, C.R. and S.P. Epperly. 2006. Seasonal sea turtle mortality risk from forced submergence in bottom trawls. Fisheries Research 81: 86-88.

Schmid, J.R., and W.N. Witzell. 1997. Age and growth of wild Kemp's ridley turtles (*Lepidochelys kempi*): cumulative results of tagging studies in Florida. Chelonian Conservation and Biology 2(4):532-537.

Schultz, J.P. 1975. Sea turtles nesting in Surinam. Zoologische Verhandelingen (Leiden), Number 143: 172 pp.

STDN (Sea Turtle Disentanglement Network). 2009. Northeast Region Sea Turtle Disentanglement Network Summary of Entanglement/Disentanglement Data from 2002-2008. Unpublished report compiled by NMFS NERO. 11 pp.

Sella,Y. 1982. Can sea turtles be tracked? Israel Land and Nature, 7, 97-99.

Seminoff, J.A. 2004. *Chelonia mydas*. In 2007 IUCN Red List of Threatened Species. Accessed 31 July 2009. http://www.iucnredlist.org/search/details.php/4615/summ.

Seney, E. E., and J.A. Musick. 2005. Diet analysis of Kemp's ridley sea turtles (*Lepidochelys kempii*) in Virginia. Chel. Cons. Biol. 4(4):864-871.

Seney, E.E., and J.A. Musick. 2007. Historical diet analysis of loggerhead sea turtles (*Caretta caretta*) in Virginia. Copeia 2007(2):478-489.

Shaffer, ML. 1981. Minimum population sizes for species conservation. Biosci. 31: 131-134.

Shamblin, B.M. 2007. Population structure of loggerhead sea turtles (*Caretta caretta*) nesting in the southeastern United States inferred from mitochondrial DNA sequences and microsatellite loci. Master's thesis, University of Georgia. 59 pp.

Shoop, C.R. 1987. The Sea Turtles. Pages 357-358 in R.H. Backus and D.W. Bourne, eds. Georges Bank. Cambridge, Massachusetts: MIT Press.

Shoop, C.R., and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs 6:43-67.

Short, F.T. and H.A Neckles. 1999. The effects of global climate change on seagrasses. Aquat Bot 63: 169-196.

Snover, M. 2005. Population trends and viability analyses for Pacific Marine Turtles. Pacific Islands Fishery Science Center Internal Report IR-05-08.

Snover, M.L., A.A. Hohn, L.B. Crowder, and S.S. Heppell. 2007. Age and growth in Kemp's ridley sea turtles: evidence from mark-recapture and skeletochronology. Pages 89-106 in P.T. Plotkin, ed. Biology and Conservation of Ridley Sea Turtles. Baltimore, Maryland: Johns Hopkins University Press.

Spotila, J.R., A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.T. Plotkin and F.V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: are leatherback turtles going extinct? Chelonian Conservation and Biology 2: 209-222.

Spotila, J.R., R.D. Reina, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 2000. Pacific leatherback turtles face extinction. Nature 405(6786):529-530.

Stabenau, E.K., T.A. Heming, and J.F. Mitchell. 1991. Respiratory, acid-base and ionic status of Kemp's ridley sea turtles (*Lepidochelys kempi*) subjected to trawling. Comp. Biochem. Physiol. v. 99a, no.½, 107-111.

Stephens, S.H., and J. Alvarado-Bremer. 2003. Preliminary information on the effective population size of the Kemp's ridley (*Lepidochelys kempii*) sea turtle. Page 250 in J.A. Seminoff, compiler. Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-503.

Stocker, T.F. and A. Schmittner. 1997. Influence of C02 emission rates on the stability ofthe thermohaline circulation. Nature 388: 862-865.

Suárez, A. 1999. Preliminary data on sea turtle harvest in the Kai Archipelago, Indonesia. Abstract, 2nd ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation, July 15-17, 1999, Sabah, Malaysia.

Suárez, A., P.H. Dutton, and J. Bakarbessy. 2000. Leatherback (*Dermochelys coriacea*) nesting on the North Vogelkop Coast of Irian Jaya, Indonesia. Page 260 in H.J. Kalb and T. Wibbels, compilers. Proceedings of the Nineteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-443.

Turtle Expert Working Group (TEWG). 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-409:1-96.

Turtle Expert Working Group (TEWG). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444:1-115.

Turtle Expert Working Group (TEWG). 2007. An assessment of the leatherback turtle population in the Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-555, 116 pp.

Turtle Expert Working Group (TEWG). 2009. An assessment of the loggerhead turtle population in the Western North Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-575:1-131.

Thompson, N.B. 1988. The Status of Loggerhead, *Caretta caretta*; Kemp's Ridley, *Lepidochelys kempi*; and Green, *Chelonia mydas*, Sea Turtles in U.S. Waters. Marine Fisheries Review 50(3):16-23 pp.

Townsend, D.W., A.C. Thomas, L.M. Mayer, M. Thomas and J. Quinlan. 2006. Oceanography of the Northwest Atlantic Continental Shelf. pp. 119-168. In: Robinson, A.R. and K.H. Brink (eds). The Sea, Volume 14, Harvard University Press. From a condensed version viewed online 5/02/09 at http://research.usm.maine.edu/gulfofmaine-census/about-the-gulf/oceanography.

Tynan, C.T. & DeMaster, D.P. 1997. Observations and predictions of Arctic climatic change: potential effects on marine mammals. *Arctic* **50**, 308–322.

USFWS (U.S. Fish and Wildlife Service) and NMFS (National Marine Fisheries Service). 1992. Recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*). St. Petersburg, Florida: National Marine Fisheries Service. 40 pp.

Van Houton, K.S. and O.L. Bass. 2007. Stonny oceans are associated with declines in sea turtle hatching. Curr Biol 17: R590.

Vargo, S., P. Lutz, D. Odell, E. Van Vleep, and G. Bossart. 1986. Final report: Study of effects of oil on marine turtles. Tech. Rep. O.C.S. study MMS 86-0070. Volume 2. 181 pp.

Wallace, N. 1985. Debris Entanglement in the Marine Environment: A Review. NOAA Tech. Memo. NOAA-TM-NMFS-SWFC-54. 19 p.

Waluda, C.M., Rodhouse, P.G., Podestá, G.P., Trathan, P.N. & Pierce, G.J. 2001. Surface oceanography of the inferred hatching grounds of *Illex argentinus* (Cephalopoda: Ommastrephidae) and influences on recruitment variability. *Marine Biology* **139**, 671–679.

Waring, G.T., E. Josephson, C.P. Fairfield-Walsh, and K. Maze-Foley. 2007. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2006, 2nd edition, US Department of Commerce, NOAA Technical Memorandum NMFS -NE -201.

Webster, P.J., G.1. Holland, J.A Curry, H.R. Chang. 2005. Changes in tropical cyclone number, du

Weishampel, J.F., D.A. Bagley, and L.M. Ehrhart. 2004. Earlier nesting by loggerhead sea turtles following sea surface warming. Global Change Biology 10:1424-1427.

Wilcox, J.R., G. Bouska, J. Gorham. B. Peery, amd M. Bresette. 1998. Knee deep in green turtles: Recent trends in capture rates at the St. Lucie nuclear power plant. pp 147-148. *In:* R. Byles and Y. Fernandez (compilers). Proceedings of the Sixteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-412.

Witherington, B., P. Kubilis, B. Brost, and A. Meylan. 2009. Decreasing annual nest counts in a globally important loggerhead sea turtle population. Ecological Applications 19:30-54.

Witzell, W.N. 2002. Immature Atlantic loggerhead turtles (*Caretta caretta*): suggested changes to the life history model. Herpetological Review 33(4):266-269.

Witt, M.J., A.C. Broderick, D.J. Johns, C. Martin, R. Penrose, M.S. Hoogmoed, and B.J. Godley. 2007. Prey landscapes help identify potential foraging habitats for leatherback turtles in the NE Atlantic. Marine Ecology Progress Series 337:231-243.

Witt, MJ., A.C. Broderick, M. Coyne, A. Fonnia and others. 2008. Satellite tracking highlights difficulties in the design of effe9tive protected areas for critically endangered leatherback turtles *Dermochelyscoriacea* during the inter-nesting period. Oryx 42: 296-300.

Wynne, K. and M. Schwartz. 1999. Guide to marine mammals and turtles of the U.S. Atlantic and Gulf of Mexico. Rhode Island Sea Grant, Narragansett. 115pp.

Zug, G.R., and J.F. Parham. 1996. Age and growth in leatherback turtles, *Dermochelys coriacea*: a skeletochronological analysis. Chelonian Conservation and Biology. 2(2):244-249.

Zurita, J.C., R. Herrera, A. Arenas, M.E. Torres, C. Calderon, L. Gomez, J.C. Alvarado, and R. Villavicencio. 2003. Nesting loggerhead and green sea turtles in Quintana Roo, Mexico. Pages 125-127 in J.A. Seminoff, compiler. Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-503.