Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency: National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Division

Activity: Reinitiation of Consultation on the Atlantic Highly Migratory Species Fishery Management Plan and its Associated Fisheries

Consulting Agency: National Marine Fisheries Service, Office of Protected Resources, Endangered Species Division

Approved by: ______________________

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Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. § 1531 *et seq.*) requires that each federal agency shall 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 a protected species, that agency is required to consult with either the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service, depending upon the protected species that may be affected. In this instance, NMFS has dual responsibilities under the Magnuson-Stevenson Fishery Conservation and Management Act (MSA) and ESA, respectively.

The NMFS Highly Migratory Species Division, Office of Sustainable Fisheries's proposal to authorize fisheries under the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (HMS FMP) and Amendment 1 to the Atlantic Billfish FMP places them in the role of "action agency;" while NMFS' Endangered Species Division, Office of Protected Resources is NMFS' "consulting agency". This biological opinion has been prepared by NMFS' Office of Protected Species and Southeast Regional Office, Protected Resources Division. This document constitutes the NMFS' biological opinion (Opinion) based on review of NMFS' HMS FMP and Amendment 1 to the Billfish FMP and their effects on threatened and endangered marine mammals and sea turtles in accordance with section 7 of the ESA.

This Opinion is based on information provided in the June 30, 2000, Opinion; March 8, 2001, draft Opinion prepared by NMFS Endangered Species Division, Southwest Region, on authorization of Western Pacific Region pelagic fisheries under the FMP for the Pelagic Fisheries of the Western Pacific Regions; bycatch data analyses conducted by the NMFS Southeast Fisheries Science Center (SEFSC); recent sea turtle satellite tagging studies conducted by the NMFS Honolulu Laboratory in Hawaii and contract researchers in the Azores; recent (February 2001) stock assessments of loggerhead and leatherback sea turtles including an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic, conducted by the NMFS Southeast Fisheries Science Center (NMFS 2001); recent NMFS - industry longline gear workshops and NMFS expert working group meeting held to review and discuss methods to minimize sea turtle - longline fishery interactions; the May 28, 1999, final regulations for the HMS fishery (64 FR 29090) which established a Northeast U.S. Closed Area (closed June 1-June 30 annually); the June 14, 2000 "Final Supplemental Environmental Impact Statement on the Regulatory Amendment to the Atlantic Tunas, Swordfish, and Sharks Fishery Management Plan"; the draft Technical Memorandum "Using Time and Area Closures to Minimize Incidental Catch and Bycatch in U.S. Atlantic Pelagic Longline Fisheries;" the August 1, 2000, Final Rule on Atlantic Highly Migratory Species Pelagic Longline Management (65 FR 47214) that prohibits pelagic longline fishing in certain areas including the DeSoto Canyon in the Gulf of Mexico, Charleston Bump and the East Coast of Florida at certain times; the September 27, 2000 "Environmental Assessment and Regulatory Impact Review for an Emergency Rule to Reduce Bycatch and Bycatch Mortality in the Atlantic Pelagic Longline Fishery;" the October 13, 2000, emergency regulations which closed an L-shape portion of the Northeast Distant Statistical Sampling Area (NED) from October 10, 2000, through April 9, 2001 (65 FR 60889); the February 5, 2001, technical amendment redefining the East Coast Florida and Charleston Bump closed areas and delaying the effectiveness date to March 1, 2001 (66 FR 8903); a February 16, 2001 decision memorandum on mortality of sea turtles in pelagic longline fisheries; a review of Spanish swordfish longline fishery - sea turtle interactions in the Mediterranean; communications with Spanish and Italian sea turtle - longline fishery researchers; telephone conversations with NMFS' Office of Sustainable Fisheries, Highly Migratory Species staff; meetings between the Highly Migratory Species staff and the Protected Species staff; and other sources of information. A complete administrative record of this consultation is on file in NMFS' Southeast Regional Office in St. Petersburg, Florida.

1.0 CONSULTATION HISTORY

Previous consultations. For almost two decades, fisheries targeting Highly Migratory Species have undergone many formal and informal section 7 consultations. The consultations are summarized in the June 30, 2000, Opinion and have collectively covered all components of the Atlantic pelagic fishery, including the pelagic driftnet, drift gillnet, pelagic longline, bottom longline, purse seine, and hand gear (hook and line, handline, and harpoon) in the western Atlantic, Caribbean, and Gulf of Mexico.

On September 7, 2000, NMFS' Office of Sustainable Fisheries asked the Office of Protected Resources to reinitiate consultation on the HMS fisheries, citing the need for further analyses of observer data, estimates of sea turtle mortalities from longline hook ingestion, satellite tagging data from "lightly" hooked and "deeply" hooked sea turtles, and additional population modeling of loggerhead and leatherback sea turtles to more precisely determine the impact of the pelagic longline fishery on sea turtles. On September 7, 2000, NMFS' Office of Protected Resources re-initiated consultation on all the HMS fisheries.

On November 1, 2000, the year-round closure for the DeSoto Canyon area went into effect. On March 1, 2001, the Charleston Bump area closure (February 1 - April 30) and the year-round East Florida Coast area closure, which had been scheduled for February 1, 2001, went into effect.

Implementation of the proposed VMS requirement for Atlantic pelagic longline fishing has been delayed indefinitely as a result of a September 25, 2000, decision by the U.S. District Court of the District of Columbia that the NMFS "reconsider its implementation." On January 10, 2001, NMFS issued a notice requesting additional comments on the requirement with respect to the court decision. The comment period closed February 8, 2001.

The emergency rule requiring the use of dipnets and line clippers meeting NMFS design and specification criteria to remove entangling fishing gear and reduce post-release mortality of captured sea turtles, and allowing the Atlantic pelagic longline fishery to continue operating pending issuance of the present Opinion, expired April 9, 2001. NMFS implemented an interim final rule to extend these requirements indefinitely effective April 10, 2001, so there will be no lapse in dipnet/line cutter requirements (See 66 FR 17370, March 30, 2001).

On January 17-18, 2001, NMFS hosted a technical gear/longline fishery/sea turtle interaction workshop in Silver Spring, MD, which was attended by NMFS biologists and gear experts, pelagic longline fishermen and swordfish vessel captains, and representatives of the Blue Water Fishermen's Association and NGO representatives. A previous, similar 2-day NMFS internal workshop was held in Miami, FL on August 31-September 1, 1999, and a working group on reducing turtle bycatch in the Hawaii longline fishery met in Los Angeles, CA on September 12-13, 2000.

NMFS is currently drafting a proposed rule and request for comments to amend the 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. NMFS intends to publish a proposed rule in the *Federal Register* during summer 2001. A final rule could be in place soon thereafter. These proposed changes to existing Turtle Excluder Device (TED) regulations are designed to strengthen conservation measures required in the shrimp fishery and include a proposal to increase the minimum size of the TED opening. Current TED openings may be allowing continued high incidental take of large loggerhead, green, and leatherback turtles. Since this means that a proportion of the pre-reproductive and reproductive turtles are not being excluded, it may preclude most of the benefits gained from excluding small juveniles.

During the reconsultation process on the June 30, 2000, Opinion on the HMS fisheries, the shark drift gillnet fishery component exceeded its incidental take of leatherback sea turtles authorized by the June 30 Opinion. Reconsultation on the shark drift gillnet fishery is incorporated into the present Opinion. The shark drift gillnet fishery was subsequently closed by emergency rule on March 9, 2001 through April 9, 2001 (66 FR 15045, March 15, 2001), and the large coastal shark season closed on March 24, 2001, before the fishery was allowed to reopen.

2.0 DESCRIPTION OF THE PROPOSED ACTION

NMFS's Office of Sustainable Fisheries proposes to continue implementing the HMS FMP, as amended by HMS FMP regulatory amendment (15 CFR Part 902 and 50 CFR Part 285 *et al.*), and Amendment 1 to the Atlantic Billfish FMP. This Opinion considers the effects of NMFS' continued authorization of fisheries under the HMS FMP and Billfish FMP as considered in the June 30, 2000, Opinion; implementation of the August 1, 2000, final rule; the October 13, 2000, emergency rule on the HMS longline fishery; the proposed rule (in preparation) to amend the regulations protecting sea turtles from shrimp trawling; the March 30, 2001 interim final rule requiring pelagic longline vessels to carry and use line clippers and dipnets and to reduce the level of observer coverage outside the right whale calving season from 100% to 53%.

NMFS' Office of Sustainable Fisheries proposes to take this action under the authority of the MSA; 16 U.S.C. 1801 *et seq.* The MSA is the principal federal statute governing the management of U.S. marine fisheries. The management unit covered under the Atlantic HMS FMP consists of the populations of North Atlantic swordfish (*Xiphias gladius*) north of 5˚N; western Atlantic bluefin tuna (*Thunnus thynnus*) west of a line that follows 45˚W longitude from Greenland to 10˚N, then to the southeast to 25˚W at the equator, and then south along 25˚W; Atlantic yellowfin tuna (*T. albacares*); Atlantic bigeye tuna (*T. obesus*); north Atlantic albacore tuna (*T. alalunga*) north of 5˚N; west Atlantic skipjack tuna (*Katsuwonus pelamis*); and the species of sharks that inhabit the western North Atlantic Ocean. The management unit, and fishing activity for these species, extend across federal, and in some cases, state and international jurisdictional boundaries. The management units covered under the Billfish FMP include Atlantic blue marlin and white marlin, west Atlantic sailfish in the North and South Atlantic Ocean west of

30˚W longitude, and longbill spearfish in the entire Atlantic Ocean. In the Gulf of Mexico and Caribbean Sea, these fish are also covered under the Billfish FMP.

The stated purpose of the Atlantic HMS FMP and Atlantic Billfish FMP is to maximize the net benefits of the fisheries to the region and the nation. Some of the objectives stated in the FMPs are summarized as follows:

- to rebuild overfished stocks
- avoid and reduce bycatch and bycatch mortality
- establish a foundation for international negotiation on conservation and management measures to rebuild overfished fisheries
- better coordinate domestic conservation and management of the fisheries for Atlantic tunas, swordfish, sharks, billfish, considering the multispecies nature of many HMS fisheries, overlapping regional and individual participation, international management concerns, and other relevant factors
- to develop eligibility criteria for participation in the shark and swordfish fisheries based on historical participation, including access for traditional swordfish handgear fishermen to participate fully as the stock recovers (Atlantic HMS FMP only), and
- to create a management system to make fleet capacity commensurate with resource status so as to achieve the dual goals of economic efficiency and biological conservation (Atlantic HMS FMP only).

Refer to the Final HMS FMP Volumes I, II, and III (April 1999), 15 CFR Part 902 and 50 CFR Part 635 *et al.*, and Amendment 1 to the Atlantic Billfish Fishery Management Plan (April 1999) for a complete description.

2.1 **HMS FMP and Billfish FMP**: Gear Types and Associated Management measures

2.1.1 HMS FMP Management Measures

The HMS FMP manages the following gear types: pelagic longline, bottom longline, gillnet, harpoon, purse seine, rod and reel, bandit gear and handline. (See 50 CFR 600.725 for allowable gear types in HMS fisheries.) For certain species, the FMP establishes minimize sizes and quotas, requires observers on fishing vessels and permits for certain time periods or gear. The gear prohibitions and fishing years established by the FMP are listed in Table 1. Also see Figure 1 for HMS time/area closures.

Table 1.

Fishery	**Gear Prohibitions**	**Time/Area Closure**	**Fishing Year**
Tuna	driftnet gear is prohibited	North mid-Atlantic for pelagic longlines in June (1x6 degree block: 39 to 40˚N, 68 to 74˚W)	June 1 to May 31
Swordfish	driftnet gear is prohibited	Not Implemented	June 1 to May 31
Sharks	Gillnet gear prohibited unless a NMFS-approved observer is on board; harpoon gear is prohibited	None	January 1 to December 31

In addition to the previously mentioned measures in the FMP, there are a number of other actions that affect the closure of areas to fishing. There is a regulatory amendment to the FMP to reduce bycatch and bycatch mortality from the longline fishery and there are two take reduction plans for marine mammals which affect HMS fisheries - the Atlantic Large Whale Take Reduction Plan (ALWTRP), which was implemented via a rule published February 16, 1999 (64 FR 7529) and the Atlantic Offshore Cetacean Take Reduction Plan (AOCTRP).

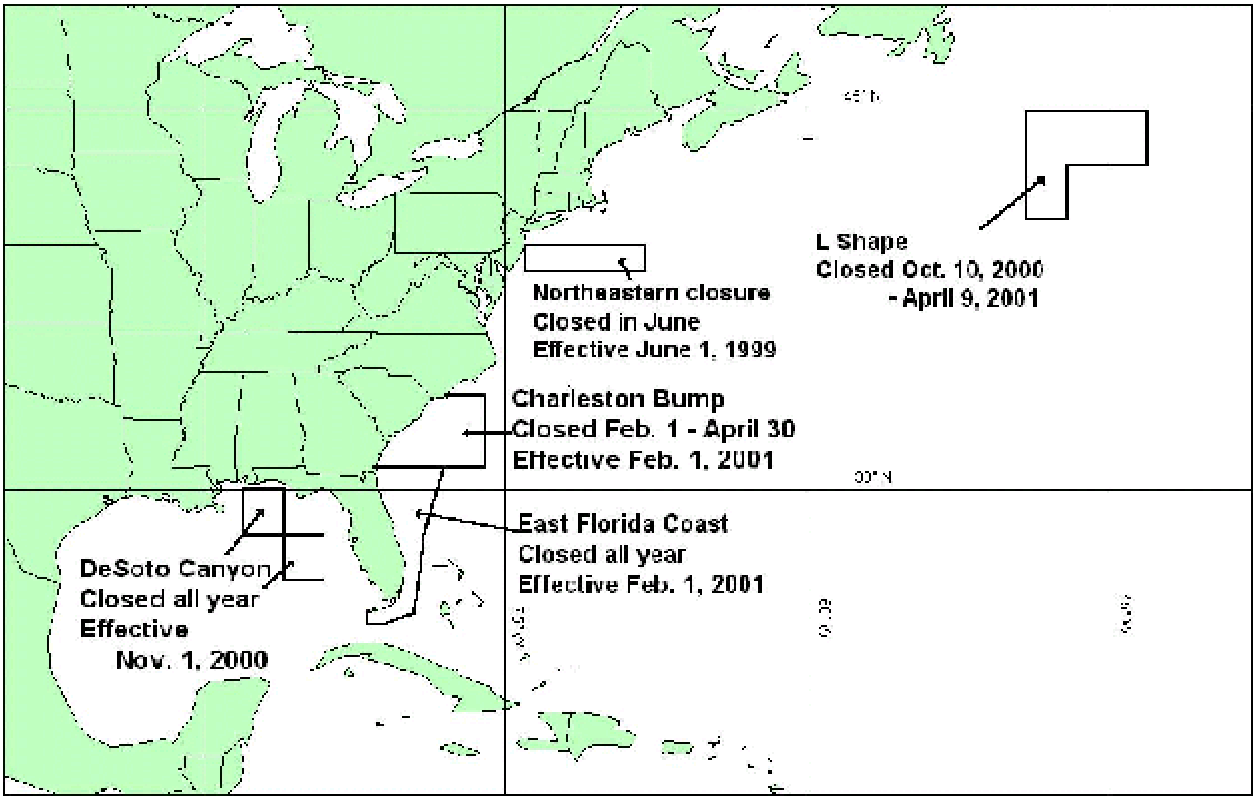

Figure 1 HMS Closed Areas, including Emergency L-Shape Closure in NED
Note: East Florida Coast and Charleston Bump Closures Delayed Until March 1, 2001 (see 66 FR 8903))

2.1.1.1 Regulatory Amendment to the HMS FMP

This amendment (August 1, 2000, Final Rule to Reduce Bycatch and Bycatch Mortality from the Atlantic Pelagic Longline Fishery) addresses bycatch and incidental catch of undersized swordfish, Atlantic billfish (marlins and sailfish), turtles, marine mammals, and other non-target species by pelagic longline gear. In 1997, NMFS began addressing this issue through the development of the draft HMS FMP and Amendment 1 to the Billfish FMP. The draft FMPs were completed in October 1998, with a proposed rule published on January 20, 1999 (63 FR 57093). On May 28, 1999, NMFS published a consolidated final rule (64 FR 29090) implementing the April 1999 Final HMS FMP, and Final Amendment 1 of the Atlantic Billfish FMP. The HMS FMP contained actions to reduce bycatch in Atlantic pelagic longline fisheries, including a limited access program for Atlantic sharks, swordfish, and tunas which reduced the number of vessels that were permitted to land Atlantic swordfish, sharks, and tunas with pelagic longline gear from over 2,000 to approximately 450 vessels. Management measures also included closure of a portion of the Mid-Atlantic Bight for the month of June to reduce bluefin tuna discards.

The bycatch reduction strategy outlined in the FMPs indicated that additional measures would subsequently be developed, including consideration of gear modifications and time/area closures. NMFS deferred implementation of the proposed Florida Straits time/area closure for protection of undersized swordfish and billfish until further analyses of the impacts of effort redistribution, and increased effectiveness with temporal and/or spatial expansion of the time/area management window. Further rationale for the delay included the potential magnitude of the economic and social impacts that would likely result from a more extensive time/area closure. Several joint HMS and Atlantic Billfish Advisory Panel (AP) meetings have been held to discuss potential effectiveness of various bycatch reduction methods.

On December 15, 1999, NMFS published a proposed rule (64 FR 69982) to close an additional 196,000 square miles of the U.S. exclusive economic zone (EEZ) to pelagic longline fishing along the Gulf of Mexico and southeastern U.S. Atlantic coast. A Draft SEIS on the proposed rule was also prepared. A detailed discussion was provided describing a suite of management options considered, including: no action (*i.e.,* status quo on all regulations impacting the pelagic longline fishery); prohibition of pelagic longline gear; 4 time/area closure scenarios (4 areas in the Gulf of Mexico and 4 areas in the southeastern U.S. Atlantic coast were examined); prohibition of the use of live bait; several alternatives to reduce turtle interactions (related to depth of hooks, water temperature and time of day); requiring use of circle hooks; reduction of soak time; and limiting access by new entrants to the fishery to further reduce fishing effort in the Atlantic pelagic longline fishery. The objectives were to maximize the reduction of finfish bycatch, minimize the reduction in the target catch of swordfish and other species, and minimize the impact on the incidental catch of other species (*e.g.,* turtles and marine mammals).

The final rule was published on August 1, 2000 and became effective September 1, 2000.
In the final rule, the proposed closure of the western Gulf of Mexico was changed to a Gulf-wide prohibition on the use of live bait with pelagic longline gear. Also, the year-round closure of the DeSoto Canyon area was added to further reduce dead discards of small swordfish. A year-round closure of the area south of 31°N latitude (the "Florida Atlantic closure area") and a February 1 through April 30 closure of the area to the north of this (from 31°N - 34° N latitude; *i.e.*, the "Charleston Bump" closure area) yielded results similar to the proposed preferred alternative, and these areas combined were selected as the revised South Atlantic closure area in the final rule (See Figure 1).

2.1.1.2 Atlantic Large Whale Take Reduction Plan (ALWTRP)

The HMS FMP addresses the ALWTRP for the shark drift gillnet component of the HMS fisheries. Measures under the FMP to prevent potential interaction between right whales and this fishery include: closure of the Southeast U.S. right whale critical habitat and adjacent area (approximately Savannah, GA to Sebastian, FL) to all gillnet gear during the calving season (November 15 - March 31) when whale distribution may coincide with the fishery (with exemption for strike gillnet gear under certain specified conditions); a 100% observer requirement from November 15 to March 31 for anyone fishing outside (to the east or south) of the closed area (*i.e.,* between Savannah, GA and approximately West Palm Beach, FL) or fishing with strikenet gear inside the closed area; and gear marking requirements. These requirements were previously implemented under the Marine Mammal Protection Act (MMPA) regulations establishing the ALWTRP. The HMS FMP adopted these regulations under authority of the MSA, to ensure regulatory consistency.

2.1.1.3 Atlantic Offshore Cetacean Take Reduction Plan (AOCTRP)

The HMS FMP addresses the *AOCTRP* recommendations for the pelagic drift gillnet fishery and the pelagic longline fishery components of the HMS fishery. The May 1999 rule prohibits the use of this gear type in targeting tuna in pelagic waters. The proposed take reduction measures largely focused on the mid-Atlantic and Northeast coastal areas, where marine mammal bycatch was highest. For the pelagic longline fishery, these measures include reducing the length of the longline to 24 nm (as a means of effort reduction) in the mid-Atlantic, retrieving the gear in reverse of the order set to decrease soak time, moving fishing location after 1 marine mammal interaction (because of the contiguous distribution of protected species bycatch noted in the observer data base), limited entry, increasing observer coverage, education/outreach workshops to increase awareness of marine mammal bycatch problems with the fishery and encourage proper techniques for disentanglement/release, and enhancing communication between fishermen. The TRT also recommended research on acoustic deterrent devices and, to prevent future expansion of the fishery into presently unexploited areas, closure of right whale critical habitats during seasons when right whales would likely be present.

The May 28, 1999, final rule implementing the HMS FMP incorporates the AOCTRP's recommendations to: move after an interaction; limit the length of longlines in the Mid-Atlantic Bight to 24 nm for one year (to assess its utility at marine mammal bycatch reduction); and limited entry. With respect to conducting fisherman education/outreach, NMFS' Office of Protected Resources and Division of Highly Migratory Species Management jointly decided that the education/outreach component of the rule should be made voluntary on a two-year trial basis, in keeping with the recommendations of the AOCTRP. NMFS' Office of Sustainable Fisheries decided against the recommendation to retrieve gear in reverse order due to human safety concerns. However, this measure is allegedly practiced by several fishermen in the longline fishery currently; thus, it is unclear whether implementation of this strategy would have been effective in reducing levels of protected species bycatch. Therefore, it is unlikely that NMFS' decision not to implement this recommendation through the HMS FMP will greatly alter the overall effectiveness of the suite of take reduction strategies recommended by the AOCTRP.

NMFS' Office of Sustainable Fisheries, in consultation with the Office of Protected Resources, determined that the right whale critical habitat closure proposed under the AOCTRP would more appropriately be implemented under the MMPA. Provided the closure was implemented under the MMPA within a reasonable time-frame, NMFS' April 23, 1999, Opinion indicated that there would be no difference in terms of the level of protection afforded right whales. However, NMFS' Office of Protected Resources has not yet addressed this issue under the MMPA. Currently, this is not a great concern because longline fishing generally doesn't take place in right whale critical habitat areas; however, the AOCTRP recommends the closure to avoid potential future expansion of HMS fisheries into such habitat areas.

2.1.2 Gear types and management measures

Pelagic longlines are a dominant commercial fishing gear used by U.S. fishermen in the Atlantic Ocean to target highly migratory species. The following is a description of the gear types used in HMS fisheries, with emphasis on the pelagic longline.

2.1.2.1 Pelagic Longline Fisheries

The U.S. pelagic longline fishery for Atlantic HMS primarily targets swordfish, yellowfin tuna, or bigeye tuna in various areas and seasons. Secondary target species include dolphin (incidentally caught in the HMS fisheries), albacore tuna, pelagic sharks including mako, thresher, and porbeagle sharks, as well as several species of large coastal sharks. Although this gear can be modified (*e.g.* depth of set, hook type, *etc.*) to target either swordfish, tunas, or sharks, like other hook and line fisheries, it is a multi-species fishery. These fisheries are opportunistic, switching gear style and making subtle changes to target the best available economic opportunity of each individual trip. Longline gear sometimes attracts and hooks non-target finfish with no commercial value, as well as species, such as billfish, that cannot be retained by commercial fishermen under NMFS regulations.

2.1.2.1.1 Pelagic Longline Gear

When targeting swordfish, the lines generally are deployed at sunset and hauled in at sunrise to take advantage of swordfish nocturnal near-surface feeding habits. In general, longlines targeting tunas are set in the morning, deeper in the water column, and hauled in the evening. Except for vessels of the distant water fleet which undertake extended trips, fishing vessels preferentially target swordfish during periods when the moon is full to take advantage of increased densities of swordfish near the surface. Pelagic longline gear is composed of several parts, as shown in Figure 2.

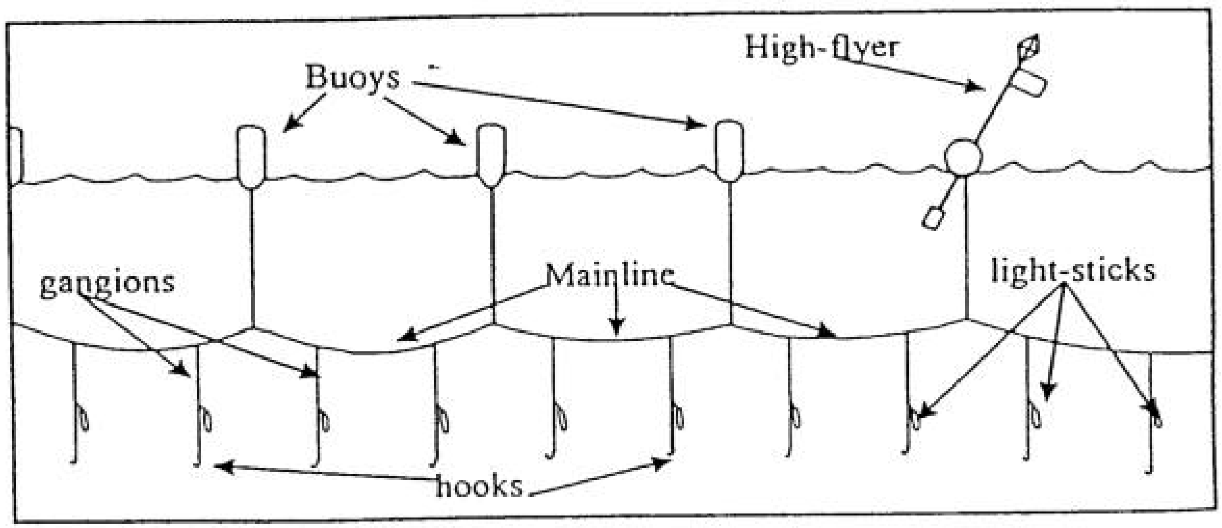

Figure 2. Typical U.S. pelagic longline gear. Source: Arocha 1996.

Figure 3, (NMFS 2001b), illustrates the difference between swordfish (shallow) and tuna (deep) longline sets.

Compared with vessels targeting swordfish or mixed species, vessels targeting tuna typically are smaller and fish different grounds. Swordfish sets are buoyed to the surface, have few hooks between floats, and are relatively shallow. This same type of gear arrangement is used for mixed target sets. Tuna sets use a different type of float placed much further apart. Compared with swordfish sets, there are more hooks per foot between the floats and the hooks are set much deeper in the water column (> 109 meters). The hooks are also different for each target type. Swordfish sets generally use "J" hooks and tuna sets use "tuna" hooks, which are more curved than "J" hooks. In addition, tuna sets use bait only while swordfish fishing uses a combination of bait and lightsticks. The number of hooks per set varies with line configuration and target catch (see Table 2).

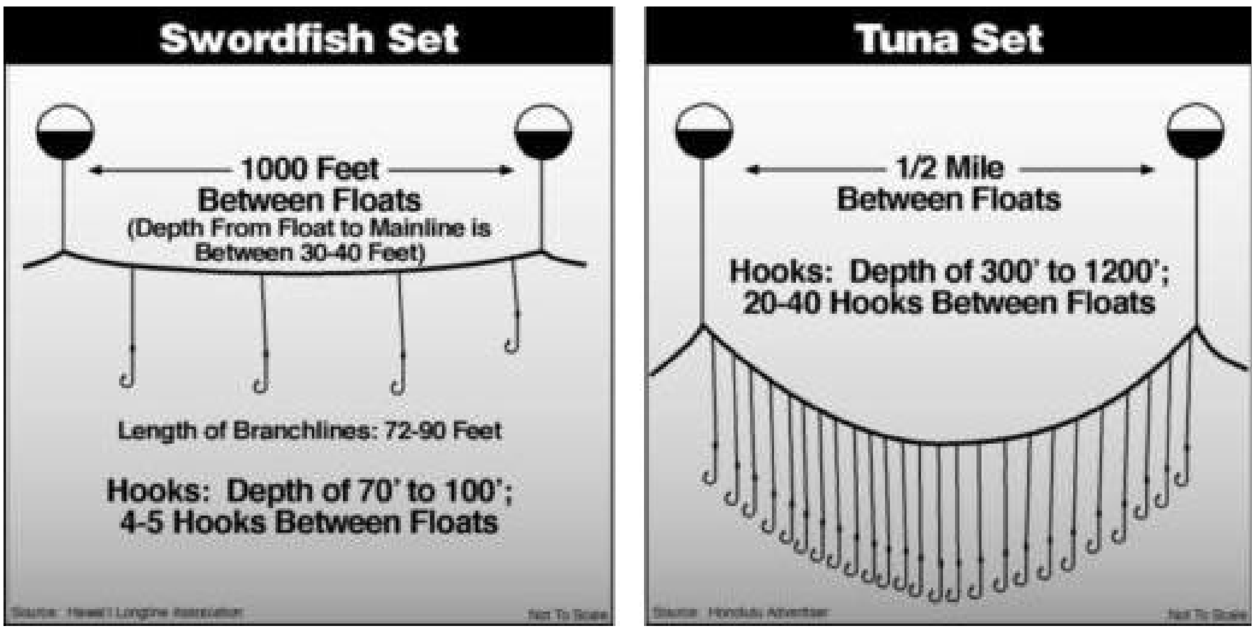

Figure 3. **Gear Configuration for Pelagic Longline Sets Targeting Swordfish vs. Tuna**

Table 2: Average Number of Hooks per set in the U.S. Pelagic Longline Fishery, 1995 through 1998.
(Source: B. Sutter, NMFS draft SAFE Report, pers. comm. 2001)

Target Species	**1995**	**1996**	**1997**	**1998**
Swordfish	500	497	500	485
Bigeye Tuna	831	804	725	732
Yellowfin Tuna	753	750	717	717
Shark	666	662	669	746
Mix	705	724	710	719

2.1.2.1.2 Pelagic Longline Catch and Discard Patterns

The pelagic longline fishery is comprised of five relatively distinct fisheries with different fishing practices and strategies, including the Gulf of Mexico yellowfin tuna fishery, the south Atlantic-Florida east coast to Cape Hatteras swordfish fishery, the mid-Atlantic and New England swordfish and bigeye tuna fishery, the U.S. distant water swordfish fishery, and the Caribbean Islands tuna and swordfish fishery. Each vessel type has different range capabilities due to fuel capacity, hold capacity, size, and construction. In addition to geographical area, segments differ by percentage of various target and non-target species, gear characteristics, bait, and deployment techniques. Some vessels fish in more than one fishery segment during the course of the year. Pelagic longline catch (including bycatch,and target catch) is largely related to these vessel and gear characteristics.

Table 3: Observer Coverage Achieved in the Atlantic Pelagic Longline Fishery, 1995 - 1999.

Year	Number of Sets Recorded	Percentage of Total Number of Sets
1995	696	5.2
1996	361	2.5
1997	448	3.1
1998	287	2.9
1999	430	4.0

2.1.2.1.3 Overview of History and Current Management of the Pelagic Longline Fishery

U.S. pelagic longline fishermen began targeting highly migratory species in the Atlantic Ocean in the early 1960s. However, U.S. landings of swordfish did not exceed 1,500 metric tons until the mid-1970s. Since that time, the gear deployed has evolved several times. The majority of fishermen use monofilament mainline that is rigged depending on whether the line is targeting tunas or swordfish. There are differences in the location, timing, and gear configuration that are specific to the tuna or swordfish target. For example, yellowfin tuna fishing tends to occur during the day while most swordfish fishing takes place at night. However, particularly during swordfish sets, longline gear hooks many different pelagic species incidentally. The incidental catch includes species which are discarded for economic and regulatory reasons. A complete discussion of the pelagic longline fishery can be found in Regulatory Amendment One to the HMS FMP (NMFS 2000a).

Pelagic longline fishermen are subject to minimum sizes for yellowfin, bigeye, and bluefin tuna, and swordfish to reduce the mortality of small fish. Pelagic longline fishermen are also subject to target catch limits in order to retain bluefin tuna. Regulatory discards compose a large portion of the bycatch in the fishery. In some areas and at certain times of the year, much of the bycatch in this fishery is released dead. Because it is difficult for pelagic longline fishermen to avoid undersized fish or bluefin tuna in some areas, NMFS has closed areas in the Gulf of Mexico and along the east coast. The intention of these closures is to relocate some of the fishing effort into areas where bycatch is expected to be lower. In order to enforce time/area closures, NMFS is considering requiring VMS on all pelagic longline vessels.

In addition to regulations designed to reduce bycatch, pelagic longline fishermen are subject to quota management for swordfish, sharks and bluefin tuna. Quota monitoring requires seasonal regulations and closures. To document catch and effort, pelagic longline fishermen are subject to permitting and reporting requirements, including logbooks and observer coverage. In 1999, NMFS established a limited entry system for swordfish, shark, and tuna longline category permits. Pelagic longline fishermen who target swordfish or BAYS (Bigeye, Albacore, Yellowfin, Skipjack) tunas must have swordfish, shark, and tuna longline category permits. NMFS is re-evaluating the limited access program and may consider gear-specific permits in the future. Pelagic longlines are possibly the most regulated of all HMS gear types due to the nature of the gear and its catch/bycatch.

2.1.2.1.4 Fish Bycatch Issues and Data Associated with the Pelagic Longline Fishery

Fish are discarded from the pelagic longline fishery for a variety of reasons. As in other HMS fisheries, swordfish, yellowfin tuna, and bigeye tuna may be discarded because they are undersized or unmarketable (*e.g.*, shark-bitten). Blue sharks, as well as some other finfish species, are discarded as a result of a limited market (resulting in low prices) and perishability of the product. Large coastal sharks are discarded from this gear during times when the trip limit is exceeded or the shark season is closed. Bluefin tuna may be discarded because target catch requirements have not been met. All billfish and protected species including mammals, sea turtles, and birds are required to be discarded. In the past, swordfish have been discarded during times when the swordfish season is closed; however, the North Atlantic swordfish quota has not been met in recent years.

Mortality of marlins, swordfish, sharks, and bluefin tuna from all fishing nations may significantly reduce the ability of these populations to rebuild and remains an important management issue. Recently, to further minimize bycatch and bycatch mortality in the pelagic longline fishery, NMFS published regulations to close areas to longline fishing and banned the use of live bait by longline vessels in the Gulf of Mexico. NMFS is also concerned about serious injuries to turtles and marine mammals as a result of interactions with pelagic longline gear.

2.1.2.1.5 Observer Program for the Pelagic Longline Fishery

A total of 430 longline sets were observed and recorded by NMFS observers in 1999 (4% coverage of a total of 11,045 sets reported). Table 3 compares observer coverage in past years for this fleet. The HMS Opinion requires that a minimum of 5% of the pelagic longline trips be selected for observer coverage for trips taken during 1999. In addition, the U.S. has agreed to an international recommendation requiring 5% observer coverage for all trips targeting yellowfin tuna and/or bigeye tuna. Unfortunately, due to logistical problems, it was not possible to place observers on all selected trips. NMFS is working towards improving compliance with observer requirements and facilitating communication between vessel operators and observer program coordinators. In addition, fishermen will be reminded of safety requirements for placement of observers, including the need to have all safety equipment on board that is required by the U.S. Coast Guard.

2.1.2.2 Bottom Longline Fishery

The Atlantic bottom longline fishery targets large coastal sharks; landings are dominated by sandbar and blacktip sharks. Gear consists of a 10-mile long monofilament mainline, with lighter weight monofilament gangions, with about 750 hooks. Fishing is conducted overnight. Commercial shark fishing effort with bottom longline gear is concentrated in the southeastern United States and Gulf of Mexico. Between 1994 and 1997, the Gulf and South Atlantic Fisheries Development Foundation's Observer Program observed 5.5 million hook hours of effort that caught more than 26,000 sharks. Their observations indicated that average bottom longline sets lasted between 10 and 15 hours. Within the limited access system for the shark fishery using bottom longline gear, NMFS estimates that approximately 211 and 578 vessels are eligible for directed and incidental shark permits, respectively.

2.1.2.3 Atlantic Pelagic Driftnets

While considered under the HMS FMP, the use of pelagic driftnets has been prohibited in the tuna fishery and in the Atlantic swordfish fishery since January 1999. Therefore, it is not an issue for this consultation.

2.1.2.4 Atlantic Coastal Driftnets

The HMS FMP bans coastal driftnets for BAYS tuna but NMFS has issued exempted fishing permits under certain conditions. Bluefish, dogfish, and other species that are not covered under the HMS FMP are caught using coastal drifnets and will be considered under separate consultation and in the baseline for this Opinion.

2.1.2.5 Southeast Shark Drift Gillnets

Drift gillnets are typically 275 to 1,800 m long and 3.2 to 4.1 m deep, with stretched mesh from 12.7 to 29.9 cm. Approximately 12 to15 vessels use gillnets. Fishing trips are usually less than 18 hours long and in nearshore areas within 30 nm from port. Recent legislation in South Carolina, Georgia, and Florida has prohibited the use of commercial gillnets in state waters, thereby forcing some of these vessels into deeper waters under federal jurisdiction, where gillnets are less effective. The HMS FMP requires 100% observer coverage in the shark drift gillnet fishery during the right whale calving season and 53% during the remainder of the year, and prohibits the use of gillnets to fish for sharks unless a NMFS-approved observer is aboard.

2.1.2.6 Purse Seines

A purse seine is a floated and weighted encircling net (mesh size from 3 to 4.3 inches) that is closed by means of a drawstring threaded through rings attached to the bottom of the net. The floatline can be between 950 to 1200 yards long and the purse line can be between 1000 and 2200 yards long. The leadline ranges from 950 to 1,415 yards. Purse seine gear is a pelagic gear used to target species such as herring, mackerel, and tuna. Similar to midwater trawl gear, purse seine gear has a negligible catch of multispecies, as the gear is designed to fish in the upper layers of the water column for fish schooling at or near the surface of the ocean. In addition, as opposed to trawl gear, purse seine gear is not towed through the water column, giving demersal species the opportunity to escape. Five boats in the HMS fishery are equipped with purse seines.

2.1.2.7 Handgear (Rod and Reel, Bandit Gear, Handline, and Harpoon)

The handgear fishery for HMS includes private vessels, charter vessels, and headboat vessels. Small bluefin tuna are typically caught by trolling with artificial lures, although chunking has become popular in some areas, using rod and reel. Giant bluefin tuna are harpooned (a commercial fishery), or are caught by trolling, or by chumming and drifting with several types of hook and line gear. Mackerel, whiting, mullet, ballyhoo, and squid are usual choices for bait.

Recreational fishing for medium and giant bluefin tuna with rod and reel generally takes place between December and February off North Carolina. Smaller bluefin tuna are generally targeted off Virginia, Delaware, and Maryland in early to mid-summer, with the center of activity moving northward into the New York Bight as the season progresses. Giant bluefin tuna are generally caught with handgear in Cape Cod Bay, the Gulf of Maine, and other New England waters during summer and early fall. Fishing usually takes place between eight and 200 km from shore.

As part of the limited access program implemented in the HMS FMP, NMFS issued handgear permits to fishermen who provide documentation of having been issued a swordfish permit for use with harpoon gear or who landed swordfish with handgear, as evidenced by logbook records, verifiable sales slips or receipts from registered dealers, or state landing records. NMFS issued handgear permits to those applicants who met the earned income requirement. There are approximately 20,000 vessels permitted to use rod and reel, either recreational or commercial, for Atlantic tuna.

2.2 Description of the Current HMS Fisheries

The fisheries for highly migratory species have been described extensively in the HMS FMP the Billfish FMP, and in previous consultations, as noted above; these descriptions are incorporated herein by reference. Definitions of the various gear-types used in HMS fisheries are provided in *2.1.2 Gear and Management Measures*, above. Recreational fisheries for all HMS managed species groups also exist. Collectively, these fisheries are prosecuted throughout the U.S. Atlantic EEZ and beyond. HMS fisheries include fisheries targeting swordfish, tuna, bluefin tuna, sharks, and billfish, as described below.

Total (preliminary) reported U.S. catch of tuna and tuna-like fishes (including swordfish, but excluding other billfishes) in 1998 was 26,631 metric tons (mt). This represents a decrease of 2,883 mt (10% decrease) from 1997. Estimated swordfish catch (including estimated dead discards) decreased 185 mt to 3,655 mt, and provisional landings from the U.S. fishery for yellowfin in the Gulf of Mexico decreased in 1998 to 2,006 from 2,634 in 1997. The estimated 1998 Gulf of Mexico landings of yellowfin accounted for 36% of the estimated total U.S. yellowfin landings in 1998. U.S. vessels fishing in the northwest Atlantic landed an estimated 1,234 mt of bluefin, a decrease of 99 mt compared to 1997. Provisional skipjack landings increased by 21 mt to 105 mt from 1997 to 1998, estimated bigeye landings decreased by 208 mt compared to 1997 to an estimated 928 mt in 1998, and estimated albacore landings increased from 1997 to 1998 by 249 mt to 830 mt.

For 1999, the provisional estimate of U.S. vessel landings and dead discards of swordfish was 3,585 mt (99 % of these are longline landings and discards). This estimate is somewhat lower than the estimate of 3,660 mt for 1998. Decline in U.S. landings of swordfish from the 1990 level was at least in part due to U.S. implementation of quotas. The 1999 stock assessment shows a potential reward for these fishermen who have been subject to increasingly restrictive management measures. With a rebuilding plan in place, it is hoped that the strong year classes of young swordfish will be protected throughout their lives and stock size will begin to increase. Anecdotal evidence indicates more small swordfish are being encountered by pelagic longline fishermen throughout the Atlantic Ocean.

The U.S. longline fleet has historically accounted for a small percentage of total Atlantic landings of HMS (Table 4). Even including U.S. discards for bluefin tuna, swordfish, blue marlin, white marlin, and sailfish, the U.S. percentage still remains around 5 % of all longline landings reported to the International Commission for the Conservation of Atlantic Tunas (ICCAT).

Table 4:	**Estimated International Longline Landings of HMS, Other than Sharks, for All Countries in the Atlantic: 1995-1998 (mt ww)*.** Source: SCRS, 2000.			
	1996	**1997**	**1998**	**1999**
Swordfish (N.Atl + S. Atl)	31438	30375	24203	25695
Yellowfin Tuna (W. Atl)**	8569	8505	8181	10943
Bigeye Tuna	74880	68198	70302	77356
Bluefin Tuna (W. Atl.)**	528	382	764	914
Albacore Tuna (N. Atl + S. Atl)	23044	22324	20936	24936
Skipjack Tuna***	26	60	89	13
Blue Marlin (N. Atl. + S. Atl.)****	3577	3626	2390	2522
White Marlin (N. Atl. + S. Atl.)****	1171	942	831	833
Sailfish (W. Atl.)****	341	209	830	405
Total	**143,574**	**134,621**	**128,526**	**143,617**
U.S. Longline Catch (from U.S. Natl. Report, 2000)#	**5767.3**	**8931.7**	**7194.3**	**8362-8483**
U.S. Longline Catch as Percentage of Longline Total in Atlantic	**4.0**	**6.6**	**5.6**	**5.8-5.9**

* landings include those classified by the SCRS as longline landings for all areas
**Note that the U.S. has not reported participation in the E. Atlantic yellowfin tuna fishery since 1983 and has not participated in the E. Atl bluefin tuna fishery since 1982.
***includes longline and trawl catches for all countries throughout the Atlantic Ocean
****includes U.S. *dead discards*
includes swordfish longline discards and bluefin tuna discards

2.2.1 Swordfish Fishery

Swordfish are primarily taken by pelagic longline, with minimal catches by harpoon, handline, and rod and reel. Under a limited access program effective July 1, 1999, 573 vessels were permitted to land swordfish as of March 23, 2000; 244 of these permits are for directed longline fishing for swordfish and 123 permits are for directed swordfish fishing with handgear. A few of these vessels fish in the South Atlantic Ocean (south of 5^{o} N latitude). During 1993-1996, between 4,074 and 4,551 mt of swordfish were either landed or caught and discarded. In 1998 and 1999, the United States was limited to 29% of the North Atlantic total allowable catch (TAC), which is a base quota of 2,398.6 mt dw (dressed weight). The pelagic longline fishery operates year-round in all pelagic waters of the U.S. EEZ and beyond (see Figure 4), and currently accounts for approximately 98% of the U.S. domestic swordfish landings. About 16-31% of U.S. swordfish landings are harvested on the Grand Banks. NMFS believes that U.S. fishing effort on the Grand Banks is likely capped, due to limited access and upgrading restrictions, and has decreased. The NMFS Pelagic Logbook Newsletter reports that 22 U.S. boats fished on the Grand Banks in 1996 and 1997 (making 710 and 762 sets, respectively), 15 boats and 618 sets in 1998. Beideman (2001, pers. comm.) reported that in the 1990s there were more than 60 (longline) vessels fishing the Grand Banks, while only 10-12 vessels fished there in 2000. It appears, therefore, that pelagic longline effort in the Grand Banks has steadily decreased over the past few years.

Incidental catches by fishing gears other than pelagic longline and handgear are restricted to incidental commercial retention limits of 2 to 5 swordfish per trip depending on gear type, and are counted against

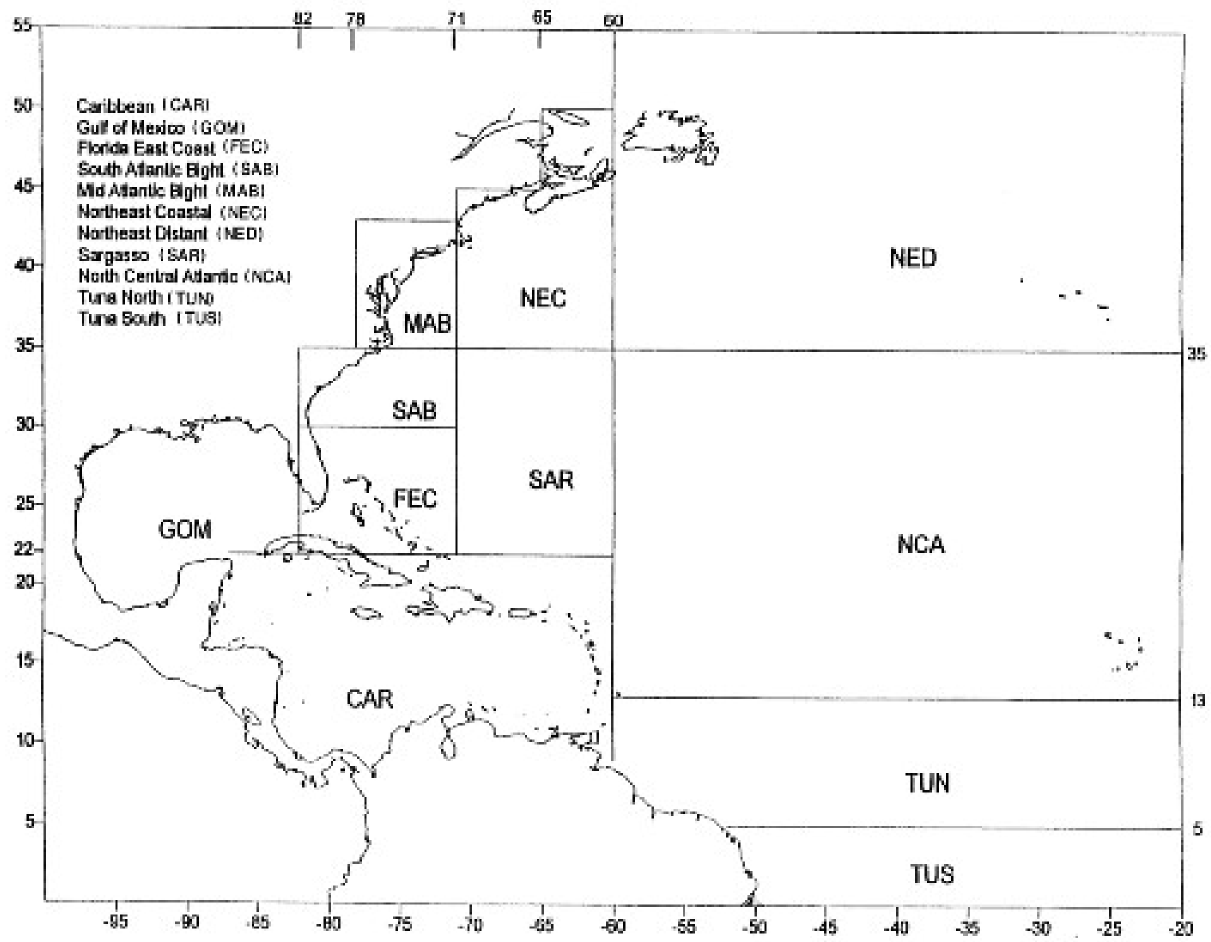

Figure 4 NMFS Statistical Areas for the Pelagic Longline Fishery for Swordfish, Tuna and Sharks. (Geographic areas used in summaries of pelagic logbook data from 1992 - 1998. Source: Cramer and Adams, 2000).

the incidental catch quota. Incidental landings are made by otter trawl vessels fishing for squid, mackerel, and butterfish (the primary prey species sought by swordfish).

2.2.2 Atlantic Tuna Fishery (other than bluefin)

Target species for the Atlantic tuna fishery include yellowfin, bigeye, north Atlantic albacore, and Atlantic skipjack. The directed fisheries for Atlantic tunas are limited by regulation to pelagic longline, rod and reel, handline, harpoon, bandit gear, and purse seine nets. The May 28, 1999, final rule implementing the HMS FMP prohibited the use of pelagic driftnets for targeting tuna. In 1999, there were 22,967 vessels permitted to participate in Atlantic tuna fisheries, including 6,827 general category vessels, 13,147 angling category vessels, 2,457 charter/headboat category vessels, 450 pelagic longline vessels, 48 harpoon category vessels, and 5 purse seine vessels. Total landings in all regions by all gear types combined ranged from 5,199.3 to 8,131.3 mt between 1993 and 1996. Of the tuna landings reported in the FMP, yellowfin tuna was by far the dominant species landed, by weight. The pelagic longline fishery accounted for between 36% and 65% of the total U.S. Atlantic yellowfin tunas landed, by weight. The rod and reel fishery landed between 27% and 63%, with all other gear types combined accounting for between 1% and 8% over the 1993-1996 period.

2.2.3 Bluefin Tuna Fishery

The commercial fishery includes primarily handgear (rod and reel, harpoon, kegline, and handline) and purse seine vessels, and is primarily focused in the mid-Atlantic and New England. While targeting bluefin, purse seine vessels operate primarily out of New Bedford and Gloucester. These vessels typically operate in New England waters east and southeast of Massachusetts, from mid-August through September. U.S. vessels fishing in the northwest Atlantic (including the Gulf of Mexico) in 1998 landed an estimated 1,234 mt of bluefin tuna and discarded dead an estimated 67 mt (total 1,301 mt). About 20% (248 mt annual average) of this is landed by purse seine vessels. In 1998, 240 bluefin tuna were landed incidentally to other fishing operations, primarily in longline fisheries targeting yellowfin tuna and swordfish. Bluefin tuna landed in the incidental category averaged 439 lbs in 1998, down from 448 lbs in 1997, and 539 lbs in 1996. Bluefin tuna were landed by 100 incidental category permit holders in 1998. In 1998, only 8% of those vessels landing under the incidental category landed more than 5 fish. Target catch requirements on the incidental catch of bluefin tuna are intended to remove any incentive to target these bluefin tuna while minimizing dead discards. The annual U.S. allowance for dead discards is currently 68 mt. If there are dead discards in excess of this allowance, they must be counted against the following year’s quota. If there are fewer dead discards, then half of the under-harvest may be added to the following year’s quota while the other half is conserved.

2.2.4 Shark Fishery

The directed shark fishery consists of 5 species groups: large coastal sharks (12 species), small coastal sharks (4 species), pelagic sharks (5 species), prohibited sharks (19 species) and deepwater/other sharks (33 species). The directed fisheries for Atlantic sharks include bottom longline, shark gillnet, and rod and reel gear, and are located primarily in the southeastern United States and Gulf of Mexico. Sharks are also caught in pelagic longline gear but the majority of these are caught incidental to other fishing operations, although pelagic longlines are sometimes used to target porbeagle and mako sharks.

The HMS FMP described a limited access program for commercial shark and swordfish fishermen that was implemented on July 1, 1999. As of March 23, 2000, there were 280 directed shark commercial permits and 598 incidental shark commercial permits.

The HMS FMP states that nearly all Atlantic commercial shark fishermen operate in the multispecies longline fishery. In an effort to rebuild these overfished stocks, in 1997 NMFS reduced the overall commercial quota by 50% to 1,285 mt for the large coastal species (LCS) group, established a 1,760 mt quota for the small coastal species (SCS) group, and maintained the commercial quota for the pelagic species group at 550 mt.

The May 28, 1999, regulations implementing the HMS FMP would have further reduced commercial quotas for sharks; however, a court order resulting from a lawsuit challenging the reduced quotas prevented their implementation. While this case has been settled, the higher 1997 quotas are still in place per the settlement agreement, pending an independent review of the science underlying the quotas.

The 1999 Shark Evaluation Annual Report indicates that estimates of 1997 landings of large coastal, pelagic, and small coastal sharks (which were preliminary at the time the HMS FMP was prepared) have been finalized, and provides preliminary estimates of 1998 landings: 2,058 mt dw of large coastal sharks; 228 mt dw of pelagic sharks; and 287 mt dw of small coastal sharks. Notable revisions indicate that large coastal sharks landings in 1997 were approximately 400 mt dw higher than previously reported, and that landings in 1998 were approximately 249 mt dw higher than the final 1997 estimates. Additionally, these landings represent a 16 mt dw decrease of pelagic sharks, and a 33 mt dw decrease of small coastal sharks from 1997 final estimates. The 1999 *Shark Evaluation Annual Report* states that:

> "Updated catches in numbers for 1997 are estimated to be higher than previously reported because complete landings statistics were not available at the time the original estimates were derived. Catches in numbers for 1998 are estimated to be about 14% higher than 1997 catches. Catch levels higher than the established quota in 1997 and 1998 are attributable to state landings after season closures, and Louisiana is the state with the highest landings."

A drift gillnet fishery for sharks is prosecuted mainly off the southern tip of Georgia and down the Florida Atlantic coast to approximately the West Palm Beach area. The fishery operates year-round, but mostly between January and October, alternating between small and large coastals as seasonal distributions and quotas permit. Participants in this fishery also participate in the Spanish mackerel gillnet fishery, and generally fish for mackerel when possible, fishing for sharks only secondarily. According to Florida Department of Environmental Protection trip ticket data, landings in this fishery were 468.6 mt (large and small coastal sharks and pelagic species combined) in 1997 and 409.6 mt in 1998. These data include bycatch landings, primarily from the Spanish mackerel fishery. No shark gillnet landings data are available from Georgia, although this is believed to represent a small fraction of the effort that takes place off the Florida coast.

Carlson and Lee (1999) provided information on catch and bycatch in the shark drift gillnet fishery off east Florida during the 1998/1999 right whale calving season (November 15 - March 31) indicating that a total of 20 sets on 20 observed vessel trips caught an estimated 2,923 animals. The catch consisted of 12 species of sharks, 21 species of teleosts and rays, and one species of marine mammal. Two species of sharks, blacktip and finetooth, made up 90% by number and 73% by weight of the observed shark catch. Bycatch was dominated by crevalle jack, Spanish mackerel, tarpon, cobia, king mackerel, spotted eagle ray, and menhaden.

According to the Highly Migratory Species Division, a group of fishermen ($n \approx 6$) in Alabama are operating a shark gillnet fishery off the coast of that state, using 8 to12-in mesh and $\geq$ 2,000 yards of net. If this fishery does develop, there is little potential for interaction with listed whales, due to their rare occurrence in the Gulf (with the exception of sperm whales, which could be impacted if the fishery is prosecuted far enough offshore or the occasional whale strays into coastal waters – especially since the DeSoto Canyon area, as noted earlier, is a "hot spot" for this species). However, sea turtles would likely be impacted at some unquantifiable level. Thus far, the fishery is operating only in state waters and therefore would fall under the purview of the HMS FMP only if the vessel owner has been issued a Limited Access Permit to participate in the shark fishery in federal waters.

2.3 FMP for the Atlantic Billfish Fishery

The fishery is recreational only with rod-and-reel gear. The fishing year is from June 1 to May 31. The FMP sets reporting and monitoring requirements, caps on annual landings, minimum size of catch, and other management measures. The fishery is concentrated from Massachusetts to North Carolina, southeast Florida, northern Gulf of Mexico, and the Caribbean. Billfish caught in commercial fisheries must be discarded. Since 1988, annual discards, on average, have been approximately 150 mt of Atlantic blue marlin and 80 mt of Atlantic white marlin. Annual recreational landings of Atlantic blue marlin have been reduced since 1988 by approximately 73% relative to pre-management levels (1980-1988); annual white marlin recreational landings have declined by approximately 90% over the same time.

Summary

The action considered in this consultation includes the following elements of the HMS fishery. Table 1 lists the general gear restrictions and fishing years established in the FMP. HMS FMP management measures specific to bycatch reduction include implementation of certain measures other than closures to reduce bycatch of marine mammals recommended by the ALWTRT and AOCTRP. The FMP also implements several closures to reduce bycatch: the final rule that closed the Florida Atlantic to longline fishing year-round and the “Charleston Bump” area from February 1 - April 30 and the DeSoto Canyon area of the Gulf of Mexico to longline fishing year-round (See Figure 1), and prohibits the use of live bait for pelagic longline fishermen in the Gulf of Mexico. In addition, a previous rule implemented the Northeast closure, effective June 1, 1999, and the October 13 emergency rule implemented the L-shape closure in the NED effective October 10, 2000 through April 9, 2001 are also part of the action (See Figure 1).

This Opinion will evaluate the continued implementation of the existing FMPs and the effects of existing rules on the fishery. The Opinion considers information regarding significant underestimates of previously determined incidental take levels, the updated status information on loggerheads and leatherbacks provided by the SEFSC, the most recent available analyses and studies of pelagic longline gear/sea turtle interactions, and information on hooked sea turtle mortality using satellite-transmitter equipped turtles, conducted before and since the June 30, 2000, Opinion was issued.

The addition of VMS as a tool to monitor the pelagic longline closure areas, though an integral part of the August 1, 2000, final rule, is not considered part of the proposed action because its implementation is currently delayed indefinitely by federal court order.

2.4 Action Area

Collectively, HMS fisheries are prosecuted throughout the U.S. EEZ in the Gulf of Mexico and Atlantic Ocean and in the high seas areas of the Atlantic. Figure 4 depicts NMFS' statistical sampling areas used for reporting of HMS catch to ICCAT. The area in Figure 4 encompasses the areas of the U.S. EEZ and the high seas where the U.S. fleet operates. Throughout their range of operation, HMS fisheries may affect listed species of sea turtles, therefore, the action area for this Opinion is the U.S. Atlantic, Gulf of Mexico and Caribbean EEZ and high seas areas depicted in the map in Figure 4.

3.0 STATUS OF AFFECTED SPECIES, CRITICAL HABITAT, AND ENVIRONMENTAL BASELINE

The following listed species under the jurisdiction of NMFS are known to occur in the pelagic waters of the North Atlantic Ocean and Gulf of Mexico:

Endangered	
Blue whale	*Balaenoptera musculus*
Humpback whale	*Megaptera novaeangliae*
Fin whale	*Balaenoptera physalus*
Northern right whale	*Eubalaena glacialis*
Sei whale	*Balaenoptera borealis*
Sperm whale	*Physeter macrocephalus*
Leatherback sea turtle	*Dermochelys coriacea*
Hawksbill sea turtle	*Eretmochelys imbricata*
Green turtle	*Chelonia mydas*
Kemp's ridley sea turtle	*Lepidochelys kempii*
Threatened	
Loggerhead sea turtle	*Caretta caretta*
Critical Habitat Designations	
Right Whale [Western North Atlantic Stock]	

(Note: 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. Atlantic and Gulf of Mexico waters.)

Since the action area for this consultation encompasses the U.S. EEZ in the Gulf of Mexico and the Atlantic Ocean and the high sea areas of the Atlantic (Figure 4), it occurs throughout the range of the species considered in this Opinion. All the listed species occurring in the action area are highly migratory, and the scope of the action area includes all pelagic areas where these species may be found within the U.S. EEZ. In addition, international activities occur in the action area. Information on the range-wide species status, normally included in a separate section of the Biological Opinion, in this case, is described by the baseline factors affecting these species within the action area. Sections on the status of listed species and the environmental baseline are combined in this Opinion.

The HMS pelagic fishery impacts sea turtles to a much larger extent than it does the large whales. When the drift gillnet portion of the fishery was still operating, interactions with large whales and the HMS fisheries would have been more likely. While whales could become entangled in longlines, it has not been recorded by federal observers in the Atlantic fishery. However, a humpback whale was observed entangled in the mainline of a Hawaii-based longline vessel (Dollar, 1991) and another was reported entangled in longline gear off Lanai (Nitta and Henderson, 1993). In May 1999, a sperm whale entanglement was recorded by a NMFS observer on a Hawaii-based swordfish longline vessel. The whale broke free of the gear and, presumably, did not suffer serious injury. Endangered whale information for species considered in this consultation is summarized annually in Stock Assessment Reports required by the MMPA. These assessments include baseline information on human and natural impacts on the stocks throughout their range and should be consulted for further information (Waring *et al.*, 2000).

Although blue whales and sei whales are found within the action area, there have been no observed interactions with fishing gear and only one report of a blue whale trailing line thought to be lobster gear (Waring *et al.* 1999). Therefore, the proposed action is not likely to adversely affect blue whales or sei whales; and they will not be considered further in this Opinion. Although the probability is low given lack of observed interactions, North Atlantic right whales, fin whales, humpback whales and sperm whales could interact with HMS gear and, consequently, are included in this Opinion.

The majority of potential impacts from the HMS pelagic fishery are on sea turtles. As part of the assessment phase of this consultation, NMFS SEFSC (2001) summarized sea turtle information concerning the observed, estimated, incidental, and stranding take levels, as well as sea turtle life stage impacted (NMFS SEFSC 2001) for U.S. federal and state activities, as well as foreign activities. These numbers must be viewed with caution even though they represent the best information currently available, because they are not directly comparable, *e.g.*, some numbers represent observed take, some represent extrapolated estimates, and some are stranded animals. Consequently, all these estimates, except the extrapolations based on known percent of observer coverage and fishing effort, are likely underestimates of true take. Incidental mortality estimates are even more uncertain.

3.1 Biology and Distribution

Background information on the range-wide status of these species and a description of critical habitat can be found in a number of published documents. General information on the potential for entanglement in the gear types used in HMS fisheries is likely to be similar to that summarized in previous consultations on the HMS fisheries as noted above, as well as consultations on the Multispecies FMP, including the June 12, 1986, November 30, 1993, February 18, 1996, and December 13, 1996 (NMFS 1996a) biological opinions and the December 21, 1998 monkfish biological opinion. Additional sources include recovery plans for sea turtles and sea turtle status documents (NMFS and USFWS 1991, 1992, 1992a, 1995), including the Marine Turtle Expert Working Group status reports on Kemp's ridley and loggerhead sea turtles (TEWG 1998, 2000), 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 (NMFS SEFSC 2001), recovery plans for the humpback whale (NMFS 1991a) and right whale (NMFS 1991b), and the 1998 marine mammal stock assessment report (Waring *et al.* 1999). Summary information on the biology of these species is provided below. Additional background information on right and humpback whales was provided in the species accounts section of the May 29, 1997, Opinion and is incorporated herein by reference. The most recent and comprehensive update on the status of loggerhead and leatherback sea turtles, as well as an extensive summary of the effects of the pelagic longline fishery on these sea turtle species, is contained in NMFS SEFSC 2001.

3.2 Right whale

Right whales have occurred historically in all the world's oceans from temperate to subarctic latitudes. NMFS recognizes three major populations of right whales: North Pacific, North Atlantic, and Southern Hemisphere. NMFS further recognizes two extant subpopulations in the North Atlantic: eastern and western. A third subpopulation may have existed in the central Atlantic (migrating from east of Greenland to the Azores or Bermuda), but this stock appears to be extinct (Perry *et al.* 1999). Because of our limited understanding of the genetic structure of the entire species, the most conservative approach to this species would treat these right whale subpopulations as distinct populations whose survival and recovery is critical to the survival and recovery of the species. Consequently, this Opinion will focus on the western north Atlantic population of right whales, which occurs in the action area.

The scarcity of right whales is the result of an 800-year history of whaling that continued into the 1960s (Klumov 1962). Of all the large whales, the northern right whale has the highest risk of extinction in the near future. Recent data indicate that there are an estimated 300 individuals in the North Atlantic and a small, unknown number of individuals in the North Pacific. The southern right whale, in contrast, has shown signs of slow recovery over the past 20 years. Illegal takes by Soviet whaling fleets operating in the North Pacific and Southern Hemisphere are now known to have continued until as recently as 1980 (Zemsky *et al.* 1995). Northern right whales have been protected for more than 60 years from the pressures of whaling, yet most stocks show no evidence of recovery.

Right whales appear to prefer shallow coastal waters, but their distribution is also strongly correlated to the distribution of their prey (zooplankton). In both northern and southern hemispheres, right whales have been observed in the lower latitudes and more coastal waters during winter, where calving takes place, and in higher latitudes during the summer. In summer and fall in both hemispheres, the distribution of right whales appears linked to the distribution of their principal zooplankton prey (Winn *et al.*1986). Right whales in the Gulf of Maine feed on zooplankton, primarily copepods, by skimming at or below the water's surface with open mouths (NMFS 1991b, Kenney *et al.* 1986, Murison and Gaskin 1989, Mayo and Marx 1990). The western north Atlantic stock of right whales generally occurs in Northwest Atlantic waters west of the Gulf Stream and is most commonly associated with cooler waters (≤ 21°C). They are not found in the Caribbean and have been recorded only rarely in the Gulf of Mexico.

NMFS designated right whale critical habitat on June 3, 1994 (59 FR 28793). These waters, which lie within the action area, include the waters of Cape Cod Bay and the Great South Channel off the coast of Massachusetts, and off the coasts of southern Georgia and northern Florida, where the species is concentrated at different times of the year. Whales are most abundant in Cape Cod Bay between February and April (Hamilton and Mayo 1990; Schevill *et al.* 1986; Watkins and Schevill 1982), in the Great South Channel in May and June (Kenney *et al.* 1986, Payne *et al.* 1990), and off Georgia/Florida from mid-November through March (Slay *et al.* 1996). Right whales also frequent the Bay of Fundy, Browns and Baccaro Banks (in Canadian waters), Stellwagen Bank, and Jeffrey's Ledge in the spring and summer months, and use mid-Atlantic waters as a migratory pathway between the winter calving grounds and their spring and summer nursery/feeding areas in the Gulf of Maine. During the winters of 1999/2000 and 2000/2001, appreciable numbers of right whales were recorded in the Charleston, SC area. Because survey efforts in the mid-Atlantic have been limited, it is unknown whether this is typical or whether it represents a northern expansion of the normal winter range, perhaps due to unseasonably warm waters. However, historical sighting data uncorrected for effort do show a concentration of sightings in this area. In addition, recent satellite tracking efforts have identified individual animals embarking on far-ranging foraging episodes not previously known (Knowlton, pers. comm.).

Since NMFS issued the 1997 biological opinion on HMS fisheries, there has been significant discussion regarding attempts to determine the current status and trend of this very small population and to make valid recommendations on recovery requirements. As reported in the 1997 Opinion, Knowlton *et al.* (1994) concluded, based on data from 1987 through 1992, that the western North Atlantic right whale population was growing at a net annual rate of 2.5% (CV = 0.12). This rate was also used in NMFS' marine mammal Stock Assessment Reports, for example, Blaylock *et al.* 1995, Waring *et al.* 1997. Since then, the data used in Knowlton *et al.* (1994) have been re-evaluated, and new attempts to model the trends of the western North Atlantic right whale population have been published (*e.g.,* Kraus 1997; Caswell *et al.* 1999) and additional works are in progress (Caswell *et al.*, in prep.; Wade and Clapham, in prep).

Recognizing the precarious status of the right whale, the continued threats present in its coastal habitat throughout its range, and the uncertainty surrounding attempts to characterize population trends, the International Whaling Commission (IWC) held a special meeting of its Scientific Committee from March 19-25, 1998, in Cape Town, South Africa, to conduct a comprehensive assessment of right whales worldwide. The workshop's participants reviewed available information on the northern right whale, including Knowlton *et al.* (1994), Kraus (1997), and Caswell *et al.* (1999). After considering this information, the workshop attendees concluded that it is unclear whether the western North Atlantic subpopulation of the right whale is "declining, stationary, or increasing, and [that] the best estimate of current population size is only 300 animals." Maintaining a conservative stance due to these uncertainties, participants concluded that the growth rate of this population "is both low and substantially less than that of the southern right whale populations" (IWC 1999).

The IWC Workshop participants expressed "considerable concern" in general for the status of the Western North Atlantic population. Based on recent (1993-1995) observations of near-failure of calf production, the significantly high mortality rate, and an observed increase in the calving interval, it was suggested that the slow but steady recovery rate published in Knowlton *et al.* (1994) may not be continuing. Workshop participants urgently recommended increased efforts to determine the trajectory of this right whale population, and NMFS' Northeast Fisheries Science Center has initiated several efforts to implement that recommendation.

Caswell *et al.* (1999), using data on reproduction and survival through 1996, determined that the western North Atlantic right whale population was declining at a rate of 2.4% per year. One model they used suggested that the mortality rate of the right whale population has increased 5-fold in less than 1 generation. According to Caswell *et al.* (1999), if the mortality rate as of 1996 does not decrease and the population performance does not improve, extinction could occur within 100 years and would be certain within 400 years, with a mean time to extinction of 191 years. In the 3 calving seasons following Caswell *et al.*'s (1999) analysis (1998-2000), only 10 calves were known to have been born into the population. The 2001 calving season brought good news for those working hard for the protection of right whales. Survey crews working off Georgia and Florida observed a record total of 30 calves between December and March.

It should be noted that no information is currently available on the response of the right whale population to recent (1997-1999) efforts to mitigate the effects of entanglement and ship strikes. Therefore, it is not possible to determine whether the trend through 1996, as reported in Caswell *et al.* (1999), is continuing. Furthermore, results reported in Caswell *et al.* (1999) suggest that it is not possible to determine that anthropogenic mortalities alone are responsible for the decline in right whale survival. However, they conclude that reduction of anthropogenic mortalities would significantly improve the species' survival probability. Given the uncertainty regarding effects of natural phenomena such as demographic and environmental stochasticity, which can influence the northern right whale population -- and assuming that the right whale population, is in fact, declining -- it is impossible to determine whether the western North Atlantic right whale population has reached the point where it would continue to decline even if all human-induced mortalities ceased.

At the 1998 IWC workshop, an inter-sessional steering group was established to review Caswell *et al.* (1999) and several other ongoing assessment efforts to identify the best and most current available scientific information on population status and trends. The IWC Scientific Committee met in May 1999 and discussed the steering group's report. Committee members noted that there were several potential negative biases in Caswell *et al.* (1999) but agreed that the results of the study should be considered in management actions.

For the purposes of this Opinion, until the new status and trend information has been thoroughly reviewed for assimilation into NMFS management programs, NMFS will continue to adopt the risk averse assumption that the northern right whale population is declining.

3.2.1 General human impacts and entanglement

The major known sources of anthropogenic mortality and injury of right whales include entanglement in commercial fishing gear and ship strikes. Right whales may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including the operation of commercial fisheries.

Based on photographs of catalogued animals from 1959 - 1989, Kraus (1990) estimated that 57% of right whales exhibited scars from entanglement and 7% from ship strikes (propeller injuries). This work was updated by Hamilton *et al.* (1998) using data from 1935 through 1995. The new study estimated that 61.6% of right whales exhibit injuries caused by entanglement, and 6.4 % exhibit signs of injury from vessel strikes. Hamilton *et al.* (1998) also reported that the increase in entanglement scarring since 1989 is a significant trend which is not attributable to increases in sighting effort or population size. In addition, several animals have apparently been entangled on more than one occasion. Some right whales that have been entangled were subsequently involved in ship strikes. These scarring percentages are primarily based on sightings of free-swimming animals that initially survive the impact which resulted in the scar. Because some animals may drown or be killed immediately, the actual number of interactions may be higher, particularly for ship strikes, as these events are most often fatal.

Many of the reports of right whale mortality cannot be attributed to a particular source. The following deaths or injuries were reported between 1996 and January 2001. (These numbers should be viewed as absolute minimum numbers; the total number of deaths and injuries cannot be estimated):

1996: One right whale was killed by a ship strike off coastal Georgia; a second right whale was killed by a ship, stranding in the vicinity of Gloucester, MA, after having been entangled in 1995. In addition to these mortalities, there were two confirmed reports of right whales becoming entangled in fishing gear. One of these was deemed to be a "serious injury" (*i.e.*, one that was likely to contribute to subsequent mortality of the animal).

1997: Another right whale was killed by a ship strike in the Bay of Fundy, and there were 8 confirmed reports of whale entanglements. Six of the entanglements were reported in Canadian waters and 2 in U.S. waters; it should be noted that we only know where 2 of the 8 entanglements occurred (one in U.S. and one in Canadian waters), and one of the reports may represent a resighting of an earlier entanglement. Three of these entanglements were deemed "serious injuries".

1998: Two adult female right whales were discovered in a weir off Grand Manan Island in the Bay of Fundy on July 12, 1998, and were released two days later; no residual injuries of concern were reported. On July 24, 1998, the disentanglement team removed line from around the tail stock of a right whale which was originally seen entangled in the Bay of Fundy on August 26, 1997. This same whale, apparently debilitated from the earlier entanglement, became entangled in lobster pot gear twice in one week in Cape Cod Bay in September 1998. The gear from the latter two entanglements was completely removed, but line from the 1997 entanglement remained in the animal's mouth. On August 15, 1998, a right whale was observed entangled in the Gulf of St. Lawrence; the animal apparently freed itself of most of the gear, but some gear may remain.

1999: Two right whale mortalities were documented, including an adult female found floating near Truro, Massachusetts, that was towed to the beach for necropsy. Based on the necropsy, scientists concluded that the whale died from complications resulting from injuries caused by a ship strike. In the fall, a second adult female died of complications caused by entanglement. Four other right whale entanglements were confirmed in 1999. There were several attempts to disentangle two of the whales. A whale sighted in the Bay of Fundy in June was nearly completely disentangled; a small piece of line remained in the mouth.

2000: A right whale identified as #2701 was found floating dead 10 miles SE of Block Island, RI on January 19, 2000. Although entangling gear (line) was seen around the tail stock, cause of death is uncertain. NMFS was unable to retrieve the carcass for examination due to extreme winter storms. Several other right whale entanglements were reported in 2000 as well, but disentanglement personnel met with little success in relocating/disentangling these animals so it is unclear how many animals were involved.

2001: Three animals have been documented dead. A newborn right whale was spotted dead off the Florida coast in February and it may have been struck by a ship. The second was a calf sighted and photographed floating dead by a passenger on a sport fishing boat off the coast of South Carolina in mid-March. The carcass was not recovered. The carcass of a young male right whale (25 feet long) was found March 17 on an island beach off Virginia. A multi-agency team necropsied the calf and took biological samples. The calf had several deep cuts consistent with injuries from a boat propellor. The biological samples are being analyzed to determine whether the external wounds were the cause of death and whether there were other contributing factors. A final report will be issued with findings as to the cause of death. This is the third confirmed right whale mortality in 2001.

3.3 Humpback whale

Humpback whales feed in the northwestern Atlantic during the summer months and migrate to calving and mating areas in the Caribbean. Five separate feeding areas are utilized in northern waters after their return; one of which, the Gulf of Maine feeding population, lies within U.S. waters and is within the action area of this consultation. Most of the humpbacks that forage in the Gulf of Maine visit Stellwagen Bank and the waters of Massachusetts and Cape Cod bays. Sightings are most frequent from mid-March through November between 41°N and 43°N, from the Great South Channel north along the outside of Cape Cod to Stellwagen Bank and Jeffreys Ledge (CeTAP 1982), and peak in May and August. Small numbers of individuals may be present in this area year-round, including the waters of Stellwagen Bank.

Katona and Beard (1990) summarized information gathered from a catalogue of photographs of 643 individuals from the western North Atlantic population of humpback whales. These photographs indicated reproductively mature western North Atlantic humpbacks winter in tropical breeding grounds in the Antilles, primarily on Silver and Navidad Banks, north of the Dominican Republic. The primary winter range also includes the Virgin Islands and Puerto Rico (see NMFS 1991a). In general, it is believed that calving and copulation take place on the winter range. Calves are born from December through March and are about 4 meters at birth. Sexually mature females give birth approximately every 2 to 3 years.

Sexual maturity is reached between 4 and 6 years of age for females and between 7 and 15 years for males. Size at maturity is about 12 meters.

Swingle *et al.* (1993) identified a shift in distribution of juvenile humpback whales in the nearshore waters of Virginia, primarily in winter months. Those whales using this mid-Atlantic area that have been identified were found to be residents of the Gulf of Maine feeding group, suggesting a shift in distribution that may be related to winter prey availability. Studies conducted by the Virginia Marine Science Museum indicate that these whales are feeding on, among other things, bay anchovies and menhaden. Researchers theorize that juvenile humpback whales, which are unconstrained by breeding requirements that result in the migration of adults to relatively barren Caribbean waters, may be establishing a winter foraging area in the mid-Atlantic (Mayo pers. comm.). In concert with the increase in mid-Atlantic whale sightings, strandings of humpback whales have increased between New Jersey and Florida since 1985. Strandings were most frequent during September through April in North Carolina and Virginia waters, and were composed primarily of juvenile humpback whales of no more than 11 meters in length (Wiley *et al.* 1995). Six of 18 humpbacks (33 %) for which the cause of mortality was determined were killed by vessel strikes. An additional humpback had scars and bone fractures indicative of a previous vessel strike that may have contributed to the whale's mortality. Sixty percent of those mortalities that were closely investigated showed signs of entanglement or vessel collision (Wiley *et al.* 1995).

Since the 1997 Opinion on HMS, new information has become available on the status and trends of the humpback whale population, although there are still insufficient data to determine population trends for the Western North Atlantic stock (Waring *et al.* 1997). The current rate of increase of the North Atlantic humpback whale population has been estimated at 9.0% (CV=0.25) by Katona and Beard (1990) and at 6.5% by Barlow and Clapham (1997). Palsboll *et al.* (1997) studied humpback whales through genetic markers to identify individual humpback whales in the northern Atlantic Ocean. Using breeding ground samples from 1992–1993, Palsboll *et al.* (1997) estimated the North Atlantic humpback whale population at 4,894 (95% confidence interval 3,374 - 7,123) males and 2,804 females (95% confidence interval 1,776 4,463), for a total of 7,698 whales. However, since the sex ratio in this population is known to be 1:1 (Palsboll *et al.* 1997), the lower figure for females is presumed to be a result of sampling bias or some other cause for partitioning of the sampling. Photographic mark-recapture analyses from the YONAH (Years of the North Atlantic Humpback) project gave an ocean-basin-wide estimate of 10,600 (95% c.i. = 9,300 - 12,100) and an additional genotype-based analysis yielded a similar but less precise estimate of 10,400 (95% c.i. = 8,000 - 13,600) (Smith *et al.* 1999). The estimate of 10,600 is regarded as the best available estimate for this population. The minimum population estimate for the North Atlantic humpback whale population is 10,019 animals (CV=0.067) (Waring *et al.* 1999).

The Northeast Fisheries Science Center (NEFSC) recommended that NMFS identify the Gulf of Maine feeding stock as the management stock for this population in U.S. waters, although a population estimate for the Gulf of Maine portion of the population is not available at this time. Stock identity of the juveniles found in the Mid-Atlantic is also unknown at this time. The NEFSC is funding a study to determine stock identity of these individuals. The results from this work will assist NMFS in determining whether multiple management units are necessary for the U.S. East Coast.

3.3.1 General human impacts and entanglement

The major known sources of anthropogenic mortality and injury of humpback whales include entanglement in commercial fishing gear and ship strikes. Humpback whales may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, and harassment resulting from a variety of activities including the operation of commercial fisheries.

Based on photographs of the caudal peduncle of humpback whales, Robbins and Mattila (1999) estimated that at least 48% -- and possibly as many as 78% -- of animals in the Gulf of Maine exhibit scarring caused by entanglement. Several animals have apparently been entangled on more than one occasion. These estimates are based on sightings of free-swimming animals that initially survive the scarring encounter. Because some animals may drown immediately, the actual number of interactions may be slightly higher. Following is a summary of recent documented cases of human interaction.

Many of the reports of mortality cannot be attributed to a particular impact source. The following injury/mortality events are those reported from 1996 to the present for which impact source was determined. These numbers should be viewed as absolute minimum numbers; the total number of mortalities and injuries cannot be estimated but is believed to be higher.

1996 Three humpback whales were killed in collisions with vessels and at least 5 were seriously injured by entanglement in the same year.

1997 Three confirmed humpback whale entanglements were reported. Stranding records from January through December 1997 for the U.S. Atlantic coast include seven stranded/dead floating humpback whales. Two of these mortalities were attributed to ship strikes.

1998 Fourteen confirmed humpback whale entanglements resulting in injury (n=13) or mortality (n=1) were reported. One of the animals with entanglement injuries stranded dead, but the role of the entanglement in the whale's death has not been determined. Three of the injured animals were completely disentangled, one partially disentangled, one partially disentangled and later shed the remaining gear, and one shed the gear without assistance from the disentanglement team. One injury from a vessel interaction was reported in 1998; the whale was seen several times after the injury, which exhibited some healing. Three incidents of dead floating humpback whales were also reported in 1998; however, cause of death has not been determined for any of these animals.

1999 Nine humpback entanglements were reported to the Center for Coastal Studies whale disentanglement team in 1999, including one mortality. This does not include Canadian entanglements.

2000 Preliminary data indicate that there were 16 possible human interactions (15 fishery interactions + 1 ship strike) and 13 whales for which no signs of entanglement or injury were sighted or reported. Of the 15 possible recorded cases of fishery interactions, 14 were alive, of which 1 was successfully disentangled and another was seen at a later date apparently free of gear. These data have not yet been fully analyzed to determine causes of mortality (in cases which resulted in death).

2001 Up to February 12, 2001, of 4 humpback whale mortalities reported to the stranding network there were 2 human interactions – 1 fishery interaction which was released alive with no gear attached and 1 ship strike which resulted in a mortality. The third animal was a floater which was not recovered and the fourth had no signs of entanglement or injury sighted or reported.

3.4 Fin Whale

The fin whale is ubiquitous in the North Atlantic and occurs from the Gulf of Mexico and Mediterranean Sea northward to the edges of the arctic ice pack (Waring *et al.* 1999). The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of right and humpback whales. Based on acoustic recordings from hydrophone arrays, however, Clark (1995) reported a general southward "flow pattern" of fin whales in the fall from the Labrador/Newfoundland region, south past Bermuda, and into the West Indies. The overall distribution may be based on prey availability. This species preys opportunistically on both invertebrates and fish (Watkins *et al.* 1984). As with humpback whales, they feed by filtering large volumes of water for the associated prey. Fin whales are larger and faster than humpback and right whales and are less concentrated in nearshore environments. Due to these traits, fin whales are less prone to entanglements than are right and humpback whales, but because they do occur in many of the same areas, the potential exists.

Hain *et al.* (1992) estimated that about 5,000 fin whales inhabit the northeastern United States continental shelf waters. Shipboard surveys of the northern Gulf of Maine and lower Bay of Fundy targeting harbor porpoise for abundance estimation provided an imprecise estimate of 2,700 (CV=0.59) fin whales (Waring *et al.* 1997).

3.4.1 General human impacts and entanglement

Of 18 fin whale mortality records collected between 1991 and 1995, 4 were associated with vessel interactions, although the proximal cause of mortality was not known.

1996 Three reports of ship strikes were received, although this was only confirmed as cause of death for 1 of the incidents. One entanglement report was received in 1996.

1997 At least five reports of entangled fin whales were received by NMFS. Four fin whales were reported as having stranded in the period from January 1, 1997, to January 1, 1998, in the Northeast Region; the cause of death was not determined for these animals.

1998 One ship strike mortality was documented in the Virginia-North Carolina border area. One entanglement mortality was reported in September 1998.

1999 Three entanglements were reported to the Center for Coastal Studies disentanglement team.

2000 Preliminary data indicate 2 finback whale mortalities; 1 was an apparent shipstrike (data have not yet been formally reviewed to determine cause of death and whether observed injuries were pre- or post-mortem, but the animal had broken ribs and vertebral processes). No signs of entanglement or injury were sighted or reported for the second animal.

2001 Through February 12, 2 dead finback whales were reported, both of which were possibly involved in ship strikes. (One had a broken jaw and the other displayed bruising and broken bones.)

3.5 Sperm whale

The sperm whale is the largest of the toothed whales, reaching a length of 18.3 m in males and 12.2 m in females (Odell 1992). Sperm whales are noted for their ability to make prolonged, deep dives. Large adult males have been observed diving over 3.3 km deep in dives lasting almost an hour and a half, with an average dive time of approximately 40 minutes (Watkins *et al.* 1993). Sperm whales feed primarily on medium to large-sized mesopelagic squids, *Architeuthis* and *Moroteuthis*. Sperm whales, especially mature males in higher latitude waters, also take significant quantities of large demersal and mesopelagic sharks, skates, and bony fishes (Clarke 1962, 1980). They may catch their food by: lying suspended and relatively motionless near the ocean floor and ambushing prey; attracting squid and other prey with bioluminescent mouths; or stunning prey with ultrasonic sounds. Sperm whales occasionally suffocate after becoming entangled in deep-sea cables that wrap around their lower jaw, and odd objects (*e.g.*, stones, rubber boots, buckets, and boards) have been found in their stomachs, suggesting that animals may at times cruise the ocean floor with open mouths. Sperm whales may ingest food with a sucking motion of the tongue; stomach contents reveal little evidence that lower jaw and teeth are used to grasp or chew prey (Würsig *et al.* 2000).

Females and juveniles form pods that are restricted mainly to tropical and temperate latitudes (between 50˚N and 50˚S) while the solitary adult males can be found at higher latitudes (between 75˚N and 75˚S) (Reeves and Whitehead, 1997). In the western North Atlantic they range from Greenland to the Gulf of Mexico and the Caribbean.

For the purposes of management, the IWC defines four stocks: the North Pacific, the North Atlantic, the Northern Indian Ocean, and Southern Hemisphere. However, Dufault's (1999) review of the current knowledge of sperm whales indicates no clear picture of the worldwide stock structure of sperm whales. In general, females and immature sperm whales appear to be restricted in range, whereas males are found over a wider range and appear to make occasional movements across and between ocean basins (Dufault 1999). Sperm whales prefer waters along outer continental shelves with a water depth of 600 m or more. They are uncommon in waters less than 300 m deep (Rice 1989), however, they are occasionally found in depths less than 100 m (Winn 1982). The best estimate of sperm whales in the western North Atlantic is 4,597 (NMFS in press).

Sperm whales have been sighted in the Gulf of Mexico in every season, with sighting rates peaking in the fall (Mullin *et al.* 1994). There may be a distinct stock of sperm whales in the northern Gulf of Mexico (Schmidly 1981, Fritts 1983, Hansen *et al.* 1995 as cited in Perry *et al.* 1999). Abundance estimates place the average size of this stock at 530 individuals (Hansen *et al.* 1995). There is no trend in population size discernable from estimates of abundance over time (Waring *et al.* 1997 and references within). Sperm whale sightings recorded from the National Oceanic and Atmospheric Administration (NOAA) vessel Oregon II from 1991 - 1997 are concentrated just beyond the 100 m depth contour in the northern Gulf of Mexico, east of the Mississippi River Delta. Recent studies conducted jointly by researchers from NMFS and Texas A&M indicate that these offshore waters are an important area for Gulf sperm whales. In fact, researchers with Texas A & M believe that the area should be considered as critical habitat for sperm whales (R. Davis, pers. comm.), as it is the only known breeding and calving area in the Gulf, for what is believed to be an endemic population.

Sperm whale populations are often organized into 2 types of groupings: breeding schools and bachelor schools. Older males are often solitary (Best 1979). Breeding schools consist of females of all ages and juvenile males. The mature females ovulate April through August in the Northern Hemisphere. During this season one or more large mature bulls temporarily join each breeding school. A single calf is born at a length of about 4 meters after a 15 month gestation period. A mature female will produce a calf every 3-6 years. Females attain sexual maturity at the mean age of 9 years and a length of about 9 m. Males have a prolonged puberty and attain sexual maturity at about age 20 and a body length of 12 m. Bachelor schools consist of maturing males who leave the breeding school and aggregate in loose groups of about

40 animals. As the males grow older they separate from the bachelor schools and remain solitary most of the year (Best 1979).

3.5.1 General human impacts and entanglement

The sperm whale was listed as endangered under the ESA in 1973. The primary factor for the species' decline that precipitated ESA listing was commercial whaling. Sperm whales were hunted in America from the 17th century through the early 1900s, but the exact number of whales harvested in the commercial fishery is not known (Townsend 1935). The IWC estimates that nearly a quarter-million sperm whales were killed worldwide in whaling activities between 1800 and 1900 (IWC 1969). With the advent of modern whaling the larger rorqual whales were targeted. However as their numbers decreased, greater attention was paid to smaller rorquals and sperm whales. From 1910 to 1982 there were nearly 700,000 sperm whales killed worldwide from whaling activities (IWC Committee for Whaling Statistics 1959-1983). Since the ban of nearly all hunting of sperm whales, there has been little evidence that human-induced mortality or injury is significantly affecting the recovery of sperm whale stocks (Perry *et al.* 1999; Waring *et al.* 1997; Blaylock *et al.* 1995).

Few instances of injury or mortality of sperm whales due to human impacts have been recorded in U.S. waters. Like sei whales, sperm whales typically inhabit waters further offshore than most U.S. commercial fisheries operate. Documented takes primarily involve offshore fisheries such as the offshore lobster pot fishery and pelagic driftnet and longline fisheries. Sperm whales have learned to depredate sablefish from longline gear in the Gulf of Alaska and toothfish from longline operations in the South Atlantic Ocean. No direct injury or mortality has been recorded during hauling operations, but lines have had to be cut when whales were caught on them (Ashford and Martin 1996). Sperm whales are also struck by ships; although no information is available on recent confirmed cases in U.S. waters. Due to the offshore distribution of this species, interactions that do occur are less likely to be reported than those involving right, humpback, and fin whales occurring in nearshore areas.

Because of their generally more offshore distribution and their benthic feeding habits, sperm whales are less subject to entanglement than are right or humpback whales. Sperm whales have been taken in the pelagic drift gillnet fishery for swordfish, and could likewise be taken in the shark drift gillnet fishery on occasions when they may occur more nearshore, although this likely does not occur often. Although no interaction between sperm whales and longlines have been recorded in the U.S. Atlantic, as noted above, interactions between sperm whales and longlines for sable fish have been noted in Alaska waters.

Preliminary data for 2000 indicate that of 10 sperm whales reported to the stranding network (9 dead and 1 injured) there was 1 possible fishery interaction, 1 ship strike (wounded with bleeding gash on side) and 8 animals for which no signs of entanglement or injury were sighted or reported. No sperm whales have stranded or been reported to the stranding network to date in 2001.

3.6 Loggerhead turtle

Loggerhead sea turtles occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans and are the most abundant species of sea turtle occurring in U.S. waters. Loggerhead sea turtles concentrate their nesting in the north and south temperate zones and subtropics, but generally avoid nesting in tropical areas of Central America, northern South America, and the Old World (Magnuson *et al.* 1990). The two largest known nesting aggregation of loggerhead sea turtles occur on Masirah and Kuria Muria Islands in Oman and along the southeast U.S. The loggerhead nesting aggregation on

Masirah Island is estimated at a minimum of 30,000 nesting females each year. This is the only large nesting colony of loggerheads in Oman and is the largest known aggregation of this species in the world (Ross and Barwani 1982).

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the gulf coast of Florida. The Turtle Expert Working Group (1998, 2000) recognized at least four genetically distinct loggerhead nesting subpopulations in the western North Atlantic and southeastern U.S. and recommended that they be considered independent demographically, consistent with the definition of a distinct vertebrate population segment (59 FR 65884-65885, December 21, 1994; 61 FR 4722-4725 February 7, 1996) and of a management unit (NMFS SEFSC 2001). A fifth subpopulation was identified in NMFS SEFSC 2001. Although NMFS has not completed the administrative processes necessary to formally recognize populations or subpopulations of loggerhead sea turtles, these sea turtles are generally grouped by their nesting locations. This is also consistent with recovery criteria which are seperated state by state. Based on the most recent reviews of the best scientific data on the population genetics of loggerhead sea turtles and analyses of their population trends (TEWG 1998, 2000; NMFS SEFSC 2001), NMFS treats these genetically distinct loggerhead turtle nesting aggregations as distinct subpopulations whose survival and recovery is critical to the survival and recovery of the species.

The subpopulations are divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29° N (approximately 7,500 nests in 1998); (2) a south Florida nesting subpopulation, occurring from 29° N on the east coast to Sarasota on the west coast (approximately 83,400 nests in 1998); (3) a Florida panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida (approximately 1,200 nests in 1998); (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez 1990) (approximately 1,000 nests in 1998) (TEWG 2000, Table 11); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (approximately 200 nests per year) (NMFS SEFSC 2001).

The importance of maintaining these subpopulations in the wild is shown by the many examples of extirpated nesting assemblages in the world. Natal homing to the nesting beach provides the genetic barrier between these subpopulations, preventing recolonization by turtles from other nesting beaches. Recent fine-scale analysis of mtDNA work from Florida rookeries indicate that population separations begin to appear between nesting beaches separated by more than 100 km of coastline that does not host nesting (Francisco *et al.* 2000); and tagging studies are consistent with these findings (Richardson 1982, Ehrhart 1979, LeBuff 1990, CMTTP). Nest site relocations greater than 100 km occur, but generally are rare (Ehrhart 1979; LeBuff 1974, 1990; CMTTP; Bjorndal *et al.* 1983).

The loggerhead sea turtles in the action area represent differing proportions of these five Western North Atlantic subpopulations, as well as unidentified subpopulations from the eastern Atlantic. This Opinion considers these subpopulations for the analysis, with particular emphasis on the northern subpopulation of loggerhead sea turtles. The continental shelf areas of the U.S. Atlantic and Gulf of Mexico include foraging habitat for benthic animals. Although the northern subpopulation produces only about 9% of the loggerhead nests in the Western North Atlantic as a whole, a higher proportion of this subpopulation are found in foraging areas from the Scotian Shelf to Georgia compared to the south Florida animals. Between 24% and 46% of the loggerhead sea turtles in this area are from the northern subpopulation (NMFS SEFSC 2001; Bass *et al.* 1999, 1998; Norrgard, 1995; Rankin-Baransky, 1997; Sears 1994, Sears *et al.* 1995). In the Carolinas, the northern subpopulation is estimated to make up from 25% to 28% of the loggerheads (NMFS SEFSC 2001; Bass *et al.* 1999, 1998). About 10% of the loggerhead sea turtles in foraging areas off the Atlantic coast of central Florida are from the northern subpopulation (Witzell *et al*. in review). In the Gulf of Mexico, most of the loggerhead sea turtles in foraging areas are from the South Florida subpopulation, although the northern subpopulation may represent about 10% of the loggerhead sea turtles in the western gulf (Bass *et al.* 1999).

Loggerheads reported captured in the pelagic longline fishery in the open ocean are mostly pelagic juveniles, although the size range does overlap pelagic stages with small benthic juveniles. (NMFS SEFSC 2001). Recent studies have suggested that not all loggerhead sea turtles follow the model of circumnavigating the North Atlantic Gyre as pelagic immatures, followed by permanent settlement into benthic environments. Some may not totally circumnavigate the north Atlantic. Some of these turtles may either remain in the pelagic habitat in the north Atlantic longer than hypothesized or they may move back and forth between pelagic and coastal habitats (Witzell in prep.). Laurent *et al.* (1998) proposed that between the strict oceanic pelagic stage and the benthic stages, immature turtles may live through an immature coastal stage in which they switch between pelagic and benthic foods and habitats. Also, some animals in the open ocean are probably adults, as they are known to make migrations between foraging grounds and nesting beaches across open ocean waters and benthic juveniles have been reported to migrate well offshore seasonally (Epperly *et al.* 1995, Shoop and Kenney 1992, Mullin and Hoggard 2000).

In the Mediterranean Sea, about 45 - 47% of the pelagic loggerheads are from the western Atlantic subpopulations, including 2% from the northern subpopulation, while the remainder originated from the Mediterranean nesting beaches (Laurent *et al.* 1998). In the vicinity of the Azores and Madeira Archipelagos, about 17-19% of the pelagic loggerheads are from the northern subpopulation, about 71-72% are from the South Florida subpopulation, and about 10-11% are from the Yucatán subpopulation (Bolten *et al*. 1998). The turtles from the Azores samples were dipnetted from the ocean's surface and represent a mixture of pelagic animals. The SEFSC report notes that these animals are smaller than those taken on pelagic longlines; although, if there is no sorting in the pelagic environment based on natal origin then these smaller animals still represent the same genetic mix that might be found in the larger animals. Consequently, these results can be applied to animals caught by the U.S. longline fleet in the North Atlantic, *i.e,* 19% of the loggerhead turtles captured would be expected to be from the northern subpopulation.

Loggerhead sea turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7-12 years. However, as noted above, studies have suggested that some of these turtles may either remain in the pelagic habitat in the north Atlantic longer than hypothesized or they may move back and forth between pelagic and coastal habitats (Witzell in prep.). Turtles in this life history stage are called “pelagic immatures” and are best known from the eastern Atlantic near the Azores and Madeira and have been reported from the Mediterranean as well as the eastern Caribbean (Bjorndal *et al*. in press). Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length they recruit to coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico.

Benthic immature loggerheads, the life stage following the pelagic immature stage, have been found from the Scotian Shelf off Maine to southern Texas, and occasionally strand on beaches in northeastern Mexico (C. Ryder, NEFSC, pers. comm., R. Márquez-M., pers. comm.). Large benthic immature loggerheads (70-91 cm) represent a larger proportion of the strandings and in-water captures (Schroeder *et al.* 1998) along the south and western coasts of Florida as compared with the rest of the coast Benthic immature loggerheads foraging in northeastern U.S. waters are known to migrate southward in the fall as water temperatures cool (Epperly *et al.* 1995; Keinath 1993; Morreale and Standora 1999; Shoop and Kenney 1992), and migrate northward in spring. Past literature gave an estimated age at maturity of 21-35 years (Frazer and Ehrhart 1985; Frazer *et al.* 1994) and the benthic immature stage as lasting at least 10-25 years. However, NMFS SEFSC (2001) reviewed the literature and constructed growth curves from new data, estimating ages of maturity among the four models ranging from 20-38 years and benthic immature stage lengths from 14-32 years.

Adult loggerhead sea turtles have been reported throughout the range of this species in the U.S. and throughout the Caribbean Sea. As discussed in the beginning of this section, they nest primarily from North Carolina southward to Florida with additional nesting assemblages in the Florida Panhandle and on the Yucatán Peninsula. Non-nesting, adult female loggerheads are reported throughout the U.S. and Caribbean Sea; however, little is known about the distribution of adult males who are seasonally abundant near nesting beaches during the nesting season. Aerial surveys suggest that loggerheads (benthic immatures and adults) in U.S. waters are distributed in the following proportions: 54% in the southeast U.S. Atlantic, 29% in the northeast U.S. Atlantic, 12% in the eastern Gulf of Mexico, and 5% in the western Gulf of Mexico (TEWG 1998).

Based on the data available, it is difficult to estimate the size of the loggerhead sea turtle population in the U.S. or its territorial waters. There is, however, general agreement that the number of nesting females provides a useful index of the species' population size and stability at this life stage. Nesting data collected on index nesting beaches in the U.S. from 1989-1998 represent the best data set available to index the population size of loggerhead sea turtles. However, an important caveat for population trends analysis based on nesting beach data is that this may reflect trends in adult nesting females but not reflect overall population growth rates. Given this caveat, between 1989 and 1998, the total number of nests laid along the U.S. Atlantic and Gulf coasts ranged from 53,014 to 92,182 annually, with a mean of 73,751.

Based on an average of 4.1 nests per nesting female and an average remigration interval of 2.5 years; (Richardson et al., 1978), Murphy and Hopkins (1984) have indirectly estimated the number of adult females in the entire population. The equation is (number of nests/4.1 * 2.5) and the result is an adult female population of 44,970. On average, 90.7% of these nests were from the south Florida subpopulation, 8.5% were from the northern subpopulation, and 0.8% were from the Florida Panhandle nest sites. There is limited nesting throughout the Gulf of Mexico west of Florida, but it is not known to which subpopulation these nesting females belong. The number of nests in the northern subpopulation from 1989 to 1998 ranged from 4,370 to 7,887, with a 10-year mean of 6,247 nests. With each female producing an average of 4.1 nests in a nesting season, the average number of nesting females per year in the northern subpopulation was 1,524. Assuming an average remigration rate of 2.5 years, the total number of nesting and non-nesting adult females in the northern subpopulation is estimated as 3,810 adult females (TEWG, 1998, 2000).

The status of this northern population based on number of loggerhead nests has been classified as stable or declining (TEWG 2000). Another consideration adding to the vulnerability of the northern subpopulation is that NMFS scientists estimate, using genetics data from Texas, South Carolina, and North Carolina in combination with juvenile sex ratios from those states, that the northern subpopulation produces 65% males, while the south Florida subpopulation is estimated to produce 80% females (NMFS SEFSC 2001).

The NMFS SEFSC report (2001) summarizes trend analyses for number of nests sampled from beaches for the northern subpopulation and the south Florida subpopulation and concluded that from 1978-1990, the northern subpopulation has been stable at best and possibly declining (less than 5% per year). From 1990 to the present, the number of nests in the northern subpopulation has been increasing at 2.8-2.9% annually; however, there are confidence intervals about these estimates that include no growth (0%). Over the same time frame, the south Florida population has been increasing at 5.3-5.4% per year from 1978-1990, and increasing at 3.9-4.2% since 1990.

From a global perspective, the southeastern U.S. nesting aggregation is a critical component of this species. It is second in size only to the nesting aggregations in the Oman and represents about 35 and 40 % of the nesting of this species globally. The status of the Oman nesting beaches has not been evaluated recently, but they are located in a part of the world that has a history of periodic, disruptive, events (*e.g.*, political upheavals, wars, and catastrophic oil spills). The resulting risk facing this nesting aggregation and these nesting beaches is cause for considerable concern (Meylan *et al*. 1995).

3.6.1 Status and Trends

There is general agreement that the number of nesting females provides a useful index of the species' population size and stability at this life stage, even though there are uncertainties in estimating the overall population size. Nesting data collected on index nesting beaches in the U.S. from 1989-1998 represent the best data set available to index the population size of loggerhead sea turtles. However, an important caveat for population trends analysis based on nesting beach data is that this may reflect trends in adult nesting females but not overall population growth rates. Adult nesting females often account for less than 1% of total population numbers (NMFS SEFSC 2001). Interpretation of trend data from nesting beaches for marine turtles is complicated over the short-term, given the species long age to sexual maturity and non-annual reproduction. The difficulties in relying on short-term nesting data to discern population trends is well illustrated by examining 34 years of nesting survey data from Little Cumberland Island, Georgia (Figure 5, Dahlen et al, 2000). When the data are apportioned into approximate decade-long intervals, as shown, conclusions of a stable nesting population can be drawn for each segment. However, when viewed in the context of the complete 34 year period, the trend is clearly downward and particularly severe. The importance of long-term survey data cannot be overestimated and a precautionary approach must be employed when long-term data are lacking or incomplete.

The recovery plan for this species (NMFS and USFWS 1991) states that southeastern U.S. loggerheads can be considered for delisting if, over a period of 25 years, adult female populations in Florida are increasing and there is a return to pre-listing annual nest numbers of 800 in North Carolina, 10,000 in South Carolina, and 2,000 in Georgia. This equates to approximately 3,100 nesting females per year at 4.1 nests per female per season and a total population of about 7,800 adult females, with a 2.5 year remigration rate. Earlier, this Opinion provided estimates of the size of the adult female northern subpopulation of loggerheads (comprising females nesting from Amelia Island, Volusia County, Florida northward), based on nesting data from 1989-1998, at 3,810 adult females. In other words, at this gross level of analysis, levels of nesting and population sizes in the northern subpopulation may be slightly less than half of the recovery plan goals. Per its stated recovery goal, the nesting Florida subpopulation is increasing.

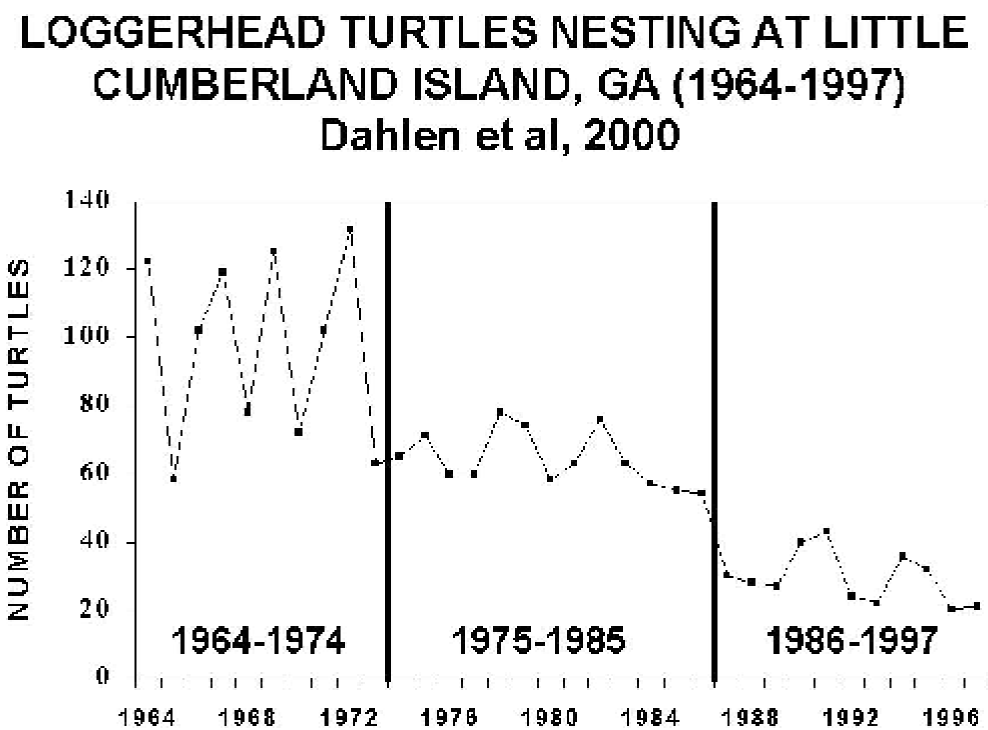

Figure 5: Long-term nesting data from Little Cumberland Island, Georgia, 1964-1997. Data source: Dahlen et al, 2000.

The TEWG (1998, 2000) concluded that the nesting trend for the northern subpopulation of loggerheads is stable or declining. The meta-analysis described in NMFS SEFSC 2001 report, however, suggests that, after 1989, the nesting activity for the northern subpopulation was increasing 2.8 to 2.9% per year but there are confidence intervals around these estimates that include no growth (The south Florida subpopulation is increasing 3.9 to 4.2% per year.) However, NMFS SEFSC (2001) cautions that "it is an unweighted analysis and does not consider the beaches' relative contribution to the total nesting activity of the subpopulation and must be interpreted with some caution." For example, South Carolina accounts for over half the total northen subpopulation nesting, and decreases in South Carolina nesting strongly affected the conclusions of TEWG (1998, 2000). In the meta-analysis, however, only a single South Carolina beach was used; and, although it has annual nestings of around 1,000, the proportional change in nesting at that beach was given equal weight to proportional changes at beaches with around 10 nests per year. Furthermore, although the analysis was limited to data from beaches where the effort was believed to have been relatively constant over time, this assumption of consistent effort may not always be true.

Several published reports have discussed the problems facing long-lived species that delay sexual maturity (Crowder *et al.* 1994). In general, these reports concluded that animals that delay sexual maturity and reproduction must have high, annual survival as juveniles through adults to ensure that enough juveniles survive to reproductive maturity and then reproduce enough times to maintain stable population sizes. This general concept can be applied to sea turtles, as shown in several studies (Crouse *et al.* 1987, Crowder *et al.* 1994, Crouse 1999). However, this would mean it would be equally long periods of time before benefits from protection would also be seen; the long benthic juvenile stages (24 and 33 years in models) means a long time before these are translated into increasing numbers of nesting females on the beach. Heppell *et al.* (in prep.) specifically showed that the growth of the loggerhead sea turtle population was particularly sensitive to changes in the annual survival of both juvenile and adult sea turtles and that the adverse effects of the pelagic longline fishery on loggerheads from the pelagic immature phase appeared critical to the survival and recovery of the species. Crouse (1999) concluded that relatively small changes in annual survival rates of both juvenile and adult loggerhead sea turtles will adversely affect large segments of the total population. NMFS SEFSC (2001) concluded that juvenile stages have the highest elasticity and maintaining or decreasing current sources of mortality in those stages will have the greatest impact on maintaining or increasing population growth rates.

3.6.2 Threats from Natural Causes

Loggerhead sea turtles face numerous threats from natural causes. The 5 known subpopulations of loggerhead sea turtles in the northwest Atlantic and southeast U.S. are subject to fluctuations in the number of young produced annually because of natural phenomena, such as hurricanes, as well as human-related activities. There is a significant overlap between hurricane seasons in the Caribbean Sea and northwest Atlantic Ocean (June to November) and the loggerhead sea turtle nesting season (March to November). Hurricanes can have potentially negative effects on the survival of eggs in sea turtle nests. However, they are normally restricted to small coastal areas In 1992, Hurricane Andrew affected turtle nests over a 90-mile length of coastal Florida. All of the eggs incubating at the time were destroyed by storm surges on beaches that were closest to the eye of this hurricane (Milton *et al*. 1994). On Fisher Island near Miami, Florida, 69 % of the eggs did not hatch after Hurricane Andrew, probably because they were inundated by the storm surge. A portion of the nests from the northern subpopulation were destroyed by hurricanes which made landfall in North Carolina in the mid to late 1990s. Sand accretion and rainfall that result from these storms can appreciably reduce hatchling success.

3.6.3. Threats from Human Activities

Some anthropogenic mortality that contributed to loggerhead declines, prior to listing under the ESA in 1978, has been mitigated over the years. These and other undocumented factors may be responsible for potentially increasing trends in nesting females seen since 1990 that appear in the NMFS SEFSC (2001) meta analysis for the northern subpopulation of loggerheads. For example, direct takes of eggs and nesting females were prohibited and actions were taken in state waters to close fisheries for various reasons (*e.g.,* sturgeon fisheries using large mesh gillnets in S. C., Florida prohibition on entangling nets). A summary of recent stranding trends provided in NMFS SEFSC (2001) notes that from 1998-2000, strandings decreased in traditionally high stranding zones on the Atlantic coast but doubled to historic levels along the southern Florida Gulf Coast and in the Florida keys, possibly due to a persistent red tide.

A number of anthropogenic impacts were identified by NRC (1990) and NMFS & USFWS (1991) for loggerhead sea turtles, but baseline analysis is complicated by the fact that these impacts (other than drowning in bottom trawls) are largely unquantified. The known sources of impact were included in NMFS SEFSC (2001) Appendix 2. These fall into several categories that impact sea turtles in the marine environment, both domestically and internationally: trawl fisheries, gillnet fisheries, hook and line fisheries, pelagic longline fisheries, pound nets, fish traps, lobster pots, whelk pots, long haul seines and channel nets, as well as non-fishery impacts such as power plants, marine pollution including marine debris, and direct harvest of eggs and adults in foreign countries, oil and gas exploration, development, and transportation, underwater explosions, dredging, offshore artificial lighting, marina and dock construction and operation; boat collisions, and poaching. On their nesting beaches in the U.S., loggerhead sea turtles are threatened with beach erosion, armoring, and renourishment; artificial lighting; beach cleaning; increased human presence; recreational beach equipment; exotic dune and beach vegetation; predation by species such as fire ants, raccoons (*Procyon lotor*), armadillos (*Dasypus novemcinctus*), opossums (*Didelphus virginianus*); and poaching. Some of these threats are discussed in more detail below. A more thorough description of anthropogenic mortality sources is provided in the TEWG reports (1998, 2000) and in NMFS SEFSC (2001).

Although sea turtle nesting beaches are protected along large expanses of the northwest Atlantic coast (in areas like Cape Canaveral National Seashore and Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Volusia County, Florida, for example, allows restricted beach driving on sea turtle nesting beaches and sea turtle nesting can be affected by beach armoring, beach renourishment, beach cleaning, artificial lighting, predation, and poaching on unprotected beaches.

The survival of juvenile loggerhead sea turtles is threatened by a completely different set of threats from human activity once they migrate to the ocean. A proportion of the pelagic immature loggerhead sea turtles from the western Atlantic circumnavigate the North Atlantic over several years (Carr 1987, Bjorndal 1994). During that period, they are exposed to a series of longline fisheries. The U.S. is only one of 23 countries fishing in the Atlantic Ocean and Mediterranean Sea with pelagic longlines from 1990-1997 (Carocci and Majowski 1998). Most of the foreign high seas fisheries in the Atlantic are similar to the U.S. in number of fishing days and miles of line per day, with some exceptions, such as the Mediterranean fleet which fishes smaller vessels, once per night and close to shore (NMFS SEFSC 2001).

Loggerheads are primarily exposed to these fleets in the pelagic juvenile stage. According to observer records, an estimated 7,891 loggerhead sea turtles were caught by the U.S. Atlantic tuna and swordfish longline fisheries between 1992-1999, of which 66 were released dead (NMFS SEFSC 2001). However, the U.S. fleet accounts for a small proportion (5-8%) of the total hooks fished in the Atlantic Ocean compared to other nations, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, U.K., Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland (Carocci and Majkowski 1998). Reports of incidental takes of turtles are incomplete for many of these nations (see NMFS SEFSC 2001 for a complete description of take records). For example, bottom set lines in the coastal waters of Madeira, Portugal, are reported to take an estimated 500 pelagic immature loggerheads each year (Dellinger and Encarnacao 2000). Based on their proportional distribution, the capture of immature loggerhead sea turtles in longline fleets in the Azores and Madeira Archipelagoes and the Mediterranean Sea will have a significant, adverse effect on the annual survival rates of juvenile loggerhead sea turtles from the western Atlantic subpopulations. Considerably more loggerheads than leatherbacks are taken in the Mediterranean Sea. Another example is the Mexican fishery in the Gulf of Mexico which incidentally captures 5 turtles per 100 trips with mortality estimated at 1.6 turtles per 100 trips. Adding up the under-represented observed takes per country per year of 23 actively fishing countries likely results in an estimate of thousands of animals annually over different life stages.

In waters off the coastal U.S., the survival of juvenile loggerhead sea turtles is affected by a suite of fisheries in federal and state waters (see *Effects of the Action*, Section 4). Loggerhead turtles are captured, injured, or killed in shrimp fisheries off the Atlantic coast; along the southeastern Atlantic coast, loggerhead turtle populations were declining in the presence of shrimp fishing off the nesting beaches, before the required use of TEDs (Magnuson *et al.* 1990). The management of shrimp harvest in the Gulf of Mexico demonstrates the correlation between shrimp trawling and impacts to sea turtles. Waters out to 200 nm are closed to shrimp fishing off of Texas each year for approximately a 3-month period (mid-May through mid-July) to allow shrimp to migrate out of estuarine waters and sea turtle strandings decline substantially during this period (NMFS, STSSN *unpublished data*).

Loggerhead sea turtles are captured in fixed pound net gear in the Long Island Sound, in pound net gear and trawls for summer flounder and other finfish fisheries in the mid-Atlantic and Chesapeake Bay, in gillnet fisheries in the mid-Atlantic and elsewhere, in fisheries for monkfish and for spiny dogfish, and in northeast sink gillnet fisheries. Capture rates of sea turtles in the longline fishery are second only to those of the U.S. shrimp fishing fleet (Crouse 1999, Magnuson *et al.* 1990), although shrimping probably does not significantly impact immature, pelagic stage loggerheads.

Although loggerhead sea turtles are most vulnerable to pelagic longlines during their pelagic, immature life history stage, there is some evidence that benthic immatures may also be captured, injured, or killed by pelagic fisheries. Any loggerhead sea turtles that follow this developmental model of moving back and forth between pelagic and coastal habitats could be adversely affected by shark gillnets and shark bottom longlines set in coastal waters, in addition to pelagic longlines.

Virtually all of the pelagic immature loggerheads taken in the Portuguese longline fleet in the vicinity of the Azores and Madeira are from western North Atlantic nesting subpopulations (Bolten *et al.* 1994, 1998) and about half of those taken in both the eastern and western basins of the Mediterranean Sea are from the western North Atlantic subpopulations (Bowen *et al.* 1993; Laurent *et al.* 1998). Aguilar *et al.* (1995) estimated that the Spanish swordfish longline fleet, which is only one of the many fleets operating in the region, captures more than 20,000 juvenile loggerheads annually, killing an estimated 20-30%. Estimated bycatch of marine turtles by the U.S. Atlantic tuna and swordfish longline fisheries, based on observer data, was significantly greater than reported in logbooks through 1997 (Johnson *et al.* 1999; Witzell 1999), but was comparable by 1998 (Yeung 1999). Observer records indicate that an estimated 6,900 loggerheads were captured by the U.S. fleet between 1992-1998, of which an estimated 43 were dead (NMFS SEFSC 2001). Aguilar *et al.* (1995) reported that hooks were removed from only 171 of 1,098 loggerheads captured in the Spanish longline fishery, describing that removal was possible only when the hook was found in the mouth, the tongue or, in a few cases, externally (flippers, *etc.*); the presumption is that all others had ingested the hook.

From 1981-1990, 397 loggerhead sea turtles were incidentally captured in gill nets set by Italian fishermen in the central Mediterranean Sea; mortality was reported to be 73.6%. An additional study estimated 16,000 loggerheads per year are captured by net with 30% mortality. Observers of the Spanish driftnet fishery in the western Mediterranean documented the incidental capture of 30 loggerheads from 1993-1994, of which one was dead; 236 loggerheads were estimated to have been caught in 1994. Six-hundred loggerheads are estimated to have been caught annually by gillnets in Nicaragua. Gillnets set for finfish and sharks in Belize are also suspected of catching sea turtles (see NMFS SEFSC 2001).

Bottom set lines in the coastal waters of Madeira, Portugal, are reported to take an estimated 500 pelagic immature loggerheads each year. Adult female loggerheads are taken by hand by the indigenous people inhabiting Boavista Island, Cape Verde, Western Africa. In Cuba, loggerheads are commercially harvested (see NMFS SEFSC 2001).

An additional source of mortality is ingestion of marine debris. A summary of marine debris impacts can be found in the TEWG reports (1998, 2000) and NMFS SEFSC (2001).

3.7 Leatherback turtle

The Recovery Plan for Leatherback Turtles (*Dermochelys coriacea*) contains a description of the natural history and taxonomy of this species (USFWS and NMFS 1992). Leatherbacks are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, Caribbean, and the Gulf of Mexico (Ernst and Barbour 1972). Adult leatherbacks forage in temperate and subpolar regions from 71˚N to 47˚S latitude in all oceans and undergo extensive migrations to and from tropical nesting beaches between 90˚N and 20˚S. In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland and Labrador, Canada and Norway, and as far south as Uruguay and Argentina and South Africa (see NMFS SEFSC 2001).

Female leatherbacks nest from southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are in French Guiana and Surinam (see NMFS SEFSC 2001). When they leave the nesting beaches, leatherbacks move offshore but eventually utilize both coastal and pelagic waters. Leatherbacks are deep divers, with recorded dives to depths in excess of 1000 m (Eckert *et al.* 1989), but they will come into shallow waters if there is an abundance of jellyfish nearshore. Leary (1957) reported a large group of up to 100 leatherbacks just offshore of Port Aransas, Texas associated with a dense aggregation of *Stomolophus*. They also occur in Buzzard's Bay and Nantucket and Vineyard Sounds during the summer and fall and in Cape Cod Bay and Narragansett Bay, particularly during the fall. Shoop and Kenney (1992) summarized 3 years of survey effort from the eastern Atlantic out to the 2000 m isobath and reported leatherback turtles throughout the study area, both inside and outside the 2000 m isobath. A summer seasonal peak in sea turtle density was noted throughout the study area (NMFS NEFSC, *unpublished data*).

The leatherback is the largest living turtle and it ranges farther than any other sea turtle species, exhibiting broad thermal tolerances (NMFS and USFWS 1995). Leatherback turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates (salps, pyrosomas) and are often found in association with jellyfish.

Although leatherbacks are a long-lived species (> 30 years), they are somewhat faster to mature than loggerheads. Age to maturity estimates for females span from as little as 3-6 years (Rhodin 1985) to 13-14 years (Zug and Porham 1996). They nest frequently (up to 7 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and thus, can produce 700 eggs or more per nesting season (Schultz 1975).

3.7.1 Genetics

Genetic analyses of leatherbacks to date indicate that within the Atlantic basin significant genetic differences occur among St. Croix, U.S. Virgin Islands, and mainland Caribbean populations (Florida, Costa Rica, Suriname/French Guiana) and between Trinidad and the same mainland populations, (Dutton *et al*. 1999) leading to the conclusion that there are at least 3 separate subpopulations of leatherbacks in the Atlantic. Much of the genetic diversity is in the relatively small insular subpopulations.

Genetic analyses indicate that female leatherback turtles nesting in St.Croix/Puerto Rico and those nesting in Trinidad differ from each other and from turtles nesting in Florida, French Guiana/Suriname and along the South African Indian Ocean coast. Turtles nesting in Florida, French Guiana/Suriname and South Africa cannot be distinguished at this time with mtDNA. The largest known nesting aggregation of the leatherback turtle in the western North Atlantic Ocean occurs in French Guiana. This may be the largest nesting aggregation of leatherback turtles in the world (see NMFS SEFSC 2001).

The analysis of mitochondrial DNA (mtDNA) indicate that the loss of the nesting populations from the St. Croix region and Trinidad would essentially eliminate most of the detected mtDNA variation throughout the Atlantic (Dutton *et al*. 1999). To date, no studies have been published on the genetic make-up of pelagic or benthic leatherbacks in the Atlantic. Compared to current knowledge regarding loggerhead populations, the genetic distinctness of leatherback populations is less clear and populations or subpopulations of leatherback sea turtles have not been formally recognized based on genetic studies. This Opinion, therefore, considers the status of the various nesting populations, as well as the Atlantic and worldwide populations.

The nesting aggregation in French Guiana has been declining at about 15% per year since 1987. From the period 1979-1986, the number of nests was increasing at about 15% annually. The number of nests in Florida and the U.S. Caribbean has been increasing at about 10.3% and 7.5%, respectively, per year since the early 1980's but the magnitude of nesting is much smaller than that along the French Guiana coast (see NMFS SEFSC 2001).

3.7.2 Status and Trends

Initial estimates of the worldwide leatherback population were between 29,000 and 40,000 breeding females (Pritchard 1971), later refined to approximately 115,000 adult females globally(Pritchard 1982). An estimate of 34,500 females (26,200 - 42,900) was made by Spotila *et al*. (1996), along with a claim that the species as a whole was declining and local populations were in danger of extinction (NMFS SEFSC 2001). They attribute this to fishery- related mortality but, at least historically, it was due primarily to intense exploitation of the eggs (Ross 1979). On some beaches in the Pacific, nearly 100% of the eggs laid have been harvested (Eckert 1996). Eckert (1996) and Spotila *et al.* (1996) record that adult mortality has also increased significantly, particularly as a result of driftnet and longline fisheries. The Pacific population is in a critical state of decline, now estimated to number less than 3,000 total adult and subadult animals (Spotila *et al.* 2000). The status of the Atlantic population is less clear. In 1996, it was reported to be stable, at best (Spotila *et al.* 1996), but numbers in the Western Atlantic at that writing were reported to be on the order of 18,800 nesting females. According to Spotila (pers. comm.), the Western Atlantic population currently numbers about 15,000 nesting females, whereas current estimates for the Caribbean (4,000) and the Eastern Atlantic (*i.e.*, off Africa, numbering ~ 4,700) have remained consistent with numbers reported by Spotila *et al.* in 1996. Spotila *et al.* (2000) indicates that between 1989 and 1995, marked leatherback returns to the nesting beach at St. Croix averaged only 48.5%, but that the overall nesting population grew. This is in contrast to a Pacific nesting beach at Playa Grande, Costa Rica, where only 11.9% of turtles tagged in 1993-94 and 19.0% of turtles tagged in 1994-95 returned to nest over the next 5 years. Characterizations of the Pacific population suggest that it has a very low likelihood of survival and recovery in the wild under current conditions. However, NMFS SEFSC (2001) note that while all these authors have noted dramatic declines in Pacific nesting beaches, they have suggested apparently stable or increasing nesting populations in the Atlantic.

Nest counts are the only reliable population information available for leatherback turtles. Recent declines have been seen in the number of leatherbacks nesting worldwide (NMFS and USFWS 1995). Natural fluctuations such as an annual cycle or the fact that females may shift their nesting efforts in places like Suriname due to erosion at French Guiana, for example, complicate analysis of trends based on that data. Another important factor is that nesting trends reflect trends in adult females, a small proportion of the population, and may not be valid for the rest of the population (NMFS SEFSC 2001). The status of the leatherback population in the Atlantic is difficult to assess since major nesting beaches occur over broad areas within tropical waters outside the United States. Although leatherbacks occur in all U.S. Atlantic, Gulf, and Caribbean waters, it is estimated that about 250 females now visit nesting sites in the U.S. (*i.e.*, Florida, Puerto Rico and the U.S. Virgin Islands)(NMFS SEFSC 2001). The primary leatherback nesting beaches occur in French Guiana, Suriname, and Costa Rica in the western Atlantic, and in Mexico in the eastern Pacific. Although increased observer effort on some nesting beaches has resulted in increased reports of leatherback nesting, declines in nest abundance have been reported from the beaches of greatest nesting densities.

The major western Atlantic nesting area for leatherbacks is located in the Suriname-French Guiana trans-boundary region. Chevalier and Girondot (1998) report that combined nesting in the two countries has been declining since 1992. Nesting also occurs on Florida's east coast. In 1998 the Florida Department of Environmental Protection reported 351 nests and 146 false crawls on the east coast of Florida. In the eastern Caribbean, nesting occurs primarily in the Dominican Republic, the Virgin Islands, and on islands near Puerto Rico. Sandy Point, on the western edge of St. Croix, Virgin Islands, has been designated by the U.S. Fish and Wildlife Service as critical habitat for nesting leatherback turtles.

The current status of nesting populations in French Guiana and Suriname is difficult to interpret because these beaches are so dynamic geologically. Schulze (1975) described a 10-year cycle of beach accretion and erosion in Guyana that could explain part of the cycle observed in nesting over the last 30 years. Chevalier *et al.* (in press) state that since the mid-1970s leatherback nesting has declined (1987-1992 mean = 40,950 nests and 1993-1998 mean = 18,100 nests). They state that there is very little shifting in nesting from French Guiana and Suriname to other Caribbean sites (there has only been 1 tag recapture elsewhere). Numbers are decreasing in Suriname, too. Chevalier *et al.* (in press) claim that there is no human-induced mortality on the beach in French Guiana, and natural mortality of adults should be low. There has been very low hatchling success on beaches used for the last 25 years.

Zug (1996) pointed out that the combination of the loss of long-lived adults in fishery related mortality, and the lack of recruitment stemming from elimination of annual influxes of hatchlings because of intense egg harvesting, has caused the sharp decline in leatherback populations. The author stated that "the relatively short maturation time of leatherbacks offers some hope for their survival if we can greatly reduce the harvest of their eggs and the accidental and intentional capture and killing of large juveniles and adults."

In summary, the conflicting information regarding the status of Atlantic leatherbacks makes it difficult to conclude whether or not the population is currently in decline. Numbers at some nesting sites are up, while at others they are down. Data collected in southeast Florida clearly indicate increasing numbers of nests for the past twenty years (9.1-11.5% increase), although it is critical to note that there was also an increase in the survey area in Florida over time (NMFS SEFSC 2001). At one site (St. Croix), population growth has been documented despite large apparent mortality of nesting females; in 1979 the number of nests is estimated to be increasing at 7.5% per year (NMFS SEFSC 2001). However, the largest leatherback rookery in the western North Atlantic remains along the northern coast of South America in French Guiana and Suriname. While Spotila *et al.* (1996) indicated that turtles may have been shifting their nesting from French Guiana to Suriname due to beach erosion, analyses show that the overall area trend in number of nests has been negative since 1987 at a rate of 15.0 - 17.3 % per year (NMFS SEFSC 2001, Appendix 1). If turtles are not nesting elsewhere, it appears that the Western Atlantic portion of the population is being subjected to mortality beyond sustainable levels, resulting in a continued decline in numbers of nesting females.

As noted above, there are many human-related sources of mortality for leatherbacks. Due to a combination of factors, including the continued harvest of eggs and adult turtles for meat, the effects of ocean pollution, it is clear that the endangered leatherback populations of the Atlantic require major conservation efforts to ensure their long-term survival and recovery in the wild.

The U.S. pelagic longline fishery, in combination with the foreign longline fleets and coastal fishery, could produce sufficient leatherback mortality to result in decreases evident on South American nesting beaches. On the other hand, large removals of eggs alone could produce the same result and would be evidenced on the nesting beach quickly. In order to determine the impact of longline fleets, there needs to be an apportionment of turtles by nesting beach origin and the mortality rate needs to be quantified which cannot be done at the current time (NMFS SEFSC 2001). Other clear concerns for South American nesting turtles are impacts on French Guiana and Suriname beaches. Even if the longline takes were eliminated, those declines would not likely reverse. On the other hand, if measures to reduce mortality occur in French Guiana and Suriname, that alone could be enough to reverse those declines.

3.7.3 Threats from human activities

Of the Atlantic turtle species, leatherback turtles seem to be the most susceptible to entanglement in fishing gear, such as lobster gear lines and longline gear, rather than swallowing hooks. This susceptibility may be the result of 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 the longline fishery. They are also susceptible to trawl capture.

Chevalier *et al.* (in press) indicate that leatherback turtles in French Guiana are threatened by fishing (longlines, drift nets, and trawling), pollution (plastic bags and chemicals), and boat propellers. Around 90% of the nests are laid within 25 km of the Maroni (also “Marowijne” or “Marouini”) River estuary. Strandings in 1997, 1998, and 1999 in the estuary were 70, 60, and 100, which Chevalier *et al.* (in press) consider underestimates. Interviews with fishermen direct observation of a 1-km gillnet with 7 dead leatherbacks along with STSSN data, indicated that there are large numbers of leatherbacks captured incidentally in large mesh nets.

In French Guiana, protected areas are generally located in nearshore areas while driftnets are set offshore. There are no such protected areas off Suriname, and fishing there occurs at the beach. Offshore nets soak overnight in Suriname; many boats fish overnight. According to Chevalier *et al.* (in press), the French Guiana government is establishing a working group to deal with accidental capture and to enforce the legislation. They will work towards the management of the fishery activity, collaborate with Suriname, study the accidental capture by the fishermen, satellite track turtles, and study strandings. The main problem appears to be the close proximity of the driftnet fishery to the nesting areas and shrimp trawling without TEDs off nesting beaches. Tag return data emphasize the global nature of the leatherback and the link between these South American nesters and animals found in U.S. waters. For example, a nesting female tagged May 29, 1990, in French Guiana was later recovered and released alive from the York River, VA. Another nester tagged in French Guiana on June 21, 1990, was later found dead in Palm Beach, Florida (STSSN database, *unpublished data*).

Swinkels and van Tienen (in press) state that, from 1995-1999, there was a large increase in leatherback nesting in Suriname. There is a nature reserve in Suriname and one in adjacent French Guiana. There were increasing population trends observed on 3 beaches but poaching of the nests was 80%. Samsambo Beach in Suriname is a very dynamic beach, which has been newly created (by natural events) and now is a nesting beach. In 1995, very few were poached but Swinkels and Tienen indicate that since that time poaching has increased. In 1999 there were > 4,000 nests, of which about 50% were poached. Because the beach had been renourished by natural processes over this period, Swinkels and Tienens hypothesized that there had been a shift in nesting activity (from other nesting areas). Their alternate hypothesis was that the new nesting represented recruitment to the population.

Leatherbacks are exposed to pelagic fisheries throughout their life cycle. 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). Leatherbacks make up a significant portion of takes in the Gulf of Mexico and South Atlantic areas, but are more often released alive. The U.S. fleet accounts for 5-8% of the hooks fished in the Atlantic Ocean. Other nations, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, U.K., Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland also fish in these waters (Carocci and Majkowski 1998). Reports of incidental takes of turtles are incomplete for many of these nations (see NMFS SEFSC 2001, for a complete description of take records). Adding up the under-represented observed takes per country per year of 23 actively fishing countries would likely result in estimates of thousands of leatherback sea turtles annually over different life stages.

3.7.3.1 1ngestion of marine debris

Leatherback sea turtles may be more susceptible to marine debris ingestion than other species due to their pelagic existence and the tendency of floating debris to concentrate in convergence zones which adults and juveniles use for feeding areas and migratory routes (Lutcavage *et al.* 1997; Shoop and Kenney 1992). 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 and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that the object may resemble a food item by its shape, color, size or even movement as it drifts about, and induce a feeding response. Although necropsies conducted between 1980 and 1992 by the Sea Turtle Stranding and Salvage Network (STSSN) participants showed that leatherbacks were more likely to ingest marine debris in the southeastern U.S. than in the northeast, it was noted that leatherbacks also consume plastic bags in the northeastern U.S. (Witzell and Teas 1994). However, when data were included through 1999, the majority (72%) of leatherbacks that had ingested marine debris or fishing gear were found from Virginia through Maine. Of 33 leatherbacks that were necropsied in New York, plastic bags were found in 10 animals (Sadove and Morreale 1990 *in* NMFS SEFSC 2001).

3.7.3.2 Entanglements

Sea turtles entangled in fishing gear generally have a reduced ability to feed, dive, surface to breathe or perform any other behavior essential to survival (Balazs 1985). They may be more susceptible to boat strikes if forced to remain at the surface, and entangling lines can constrict blood flow resulting in necrosis. Leatherbacks seem more likely to become entangled in fishing gear than other species. Leatherback entanglement in longline fishing gear is discussed in NMFS SEFSC (2001). The fish trap fishery, operating in Rhode Island from March through December, is known to capture sea turtles. Leatherbacks have been captured alive in large fish traps set off Newport, Rhode Island, most are reported to be released alive (Anonymous 1995).

From 1990 - 2000, 92 leatherbacks from New York through Maine were reported entangled in lobster pot gear between the months of June and October (NEFSC, unpublished data). There have been two additional records of leatherbacks that stranded with lobster gear attached. The leatherbacks become entangled in the buoy line and/or ground line, possibly mistaking the buoys for cannonball jellyfish (Anonymous 1995). Massachusetts, Rhode Island, Connecticut, and New York all have active lobster pot fisheries which can entangle leatherbacks (Anonymous 1995). Entanglement in lobster pot lines was cited as the leading determinable cause of adult leatherback strandings in Cape Cod Bay, Massachusetts (Prescott 1988; R. Prescott pers. comm.). Many of the stranded leatherbacks for which a direct cause of death could not be documented showed evidence of rope scars or wounds and abraded carapaces, implicating entanglement.

In the Southeast U.S. mid-Atlantic waters, the blue crab fishery is another potential source of leatherback entanglement. In North Carolina, two leatherback sea turtles were reported entangled in a crab pot buoy inside Hatteras Inlet (D. Fletcher, pers. comm.). 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 (D. Fletcher, pers. comm.). Leatherbacks become entangled in Florida's lobster pot and stone crab fisheries also, as documented on stranding forms.

Although not documented as the major cause of leatherback strandings in the U.S. Virgin Islands for the time period 1982 to1997 (1 of 5 leatherbacks stranded 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.). STSSN leatherback strandings for 1980-1999 documented significantly more strandings as a result of entanglement in the northern states (Virginia to Maine; 62%) than southern (Florida's east coast to North Carolina; 18%) or Gulf states (Florida's west coast to Texas; 19%). The majority (67%) of these strandings were the result of being entangled in crab or lobster trap lines; additional sources of entanglement included entanglement in fishing line or nets or having a hook in the mouth or flipper. (*In* NMFS SEFSC 2001.)

Leatherback sea turtles also are vulnerable to capture in gillnets. Gillnet fisheries operating in the nearshore waters of the mid-Atlantic states are likely to take leatherbacks since these fisheries and leatherbacks may co-occur; however, there is very little quantitative data on capture rate and mortality. According to the NMFS NEFSC Fisheries Observer Program, in 1994, 2 live and 2 dead leatherback sea turtles were reported incidentally captured in drift gillnets set in offshore waters from Maine to Florida (with 56% observer coverage); in 1995, 15 live and 12 dead leatherback sea turtles were reported (70% coverage); in 1996, 1 live leatherback was reported (54% coverage); in 1998, 3 live and 2 dead leatherbacks were reported (92% coverage). The NMFS NEFSC Fisheries Observer Program also had observers on the bottom coastal gillnet fishery which operates in the Mid-Atlantic, but no takes of leatherback sea turtles were observed from 1994-1998. Observer coverage of this fishery, however, ranged from <1% to 5%. In North Carolina, a leatherback was reported captured in a gillnet set in Pamlico Sound at the north end of Hatteras Island in the spring of 1990 (D. Fletcher, pers. comm.). It was released alive by the fishermen after much effort.

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 September of 1995, however, two dead leatherbacks were removed from a large (11-inch) monofilament shark gillnet set in the nearshore waters off of Cape Hatteras, North Carolina Gillnets set in northwest Atlantic coastal waters are reported to routinely capture leatherback sea turtles (Goff and Lien 1988; Goff *et al.* 1994; Anonymous 1996). Leatherbacks often 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). In the waters of coastal Nicaragua, gillnets targeting green and hawksbill turtles also incidentally catch leatherback turtles (Lagueux *et al.* 1998). An estimated 1,000 mature female leatherback sea turtles are caught annually off of Trinidad and Tobago with mortality estimated to be between 50-95% (Eckert and Lien 1999). Many of the 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).

The National Research Council Committee on Sea Turtle Conservation identified incidental capture in shrimp trawls as the major anthropogenic cause of sea turtle mortality (National Research Council 1990). Although federal regulations requiring TEDs in trawls were fully implemented in May 1991 and U.S. sea turtle strandings have declined since then (Crouse, Crowder, and Heppell *unpublished data*. as cited by Crowder *et al*. 1995), trawls equipped with TEDs are still taking large immature and adult loggerhead and green sea turtles (Epperly and Teas 1999) and leatherbacks (Henwood and Stuntz 1987). As leatherbacks make their annual spring migration north, they are likely to encounter shrimp trawls working in the nearshore waters off the Atlantic coast. Although the Leatherback Contingency Plan was developed to protect migrating leatherbacks from being incidentally captured and killed in shrimp trawls, NMFS has also had to implement additional leatherback protections outside of the contingency plan, through emergency rules in response to high strandings of leatherbacks in Florida and Texas. Because of these high leatherback strandings occurring outside the leatherback conservation zone, the lack of aerial surveys conducted in the fall, the inability to conduct required replicate surveys due to weather, equipment or personnel constraints, and the possibility that a 2-week closure was insufficient to ensure that leatherbacks had vacated the area, NMFS published an Advanced Notice of Proposed Rulemaking in April 2000 (65 FR 17852-17854, April 5, 2000) indicating that NMFS was considering publishing a proposed rule to provide additional protection for leatherback turtles in the shrimp fishery. NMFS requested all shrimp trawlers to use TEDs modified to release leatherback sea turtles along the east coast of Florida to the Georgia/Florida border through the end of March 2000 (December 11, 2000 NR00-061). This request had the effect of protecting leatherbacks during the winter Florida shrimp season that tend to stay in this area until the start of the spring migration.

Turtle excluder devices are required in the mid-Atlantic winter trawl fishery for summer flounder in waters south of Cape Charles, Virginia; however, these small TEDs can not exclude leatherback sea turtles. Although not documented, it is suspected that this and other trawl fisheries may take turtles north of Cape Charles where TEDs are not required. In Rhode Island, leatherbacks are occasionally taken by trawlers targeting scup, fluke, and monkfish in state waters (Anonymous 1995). It is likely that leatherbacks may be taken by trawlers operating off other mid-Atlantic states. Observers onboard shrimp trawlers operating in the northeastern region of Venezuela documented the capture of 48 sea turtles, of which 6 were leatherbacks, from 13,600 trawls (Marcano and Alio 2000). They estimated annual capture of all sea turtle species to be 1,370 with an associated mortality of 260 turtles, or about 19%. (NMFS SEFSC 2001).

3.7.3.3 Poaching

NMFS SEFSC (2001) notes that poaching of juveniles an adults is still occurring in the U.S. Virgin Islands, both juveniles and adults. Four of the five strandings in ST. Croix were the result of poaching

(Boulon 2000). A few cases of fishermen poaching leatherbacks have been reported from Puerto Rico, but most of the poaching is on eggs. In Ghana, nearly two thirds of the leatherback sea turtles that come up to nest on the beach are killed by local fishermen

3.8 Green turtle

Green turtles are distributed circumglobally, mainly in waters between the northern and southern 20^{o}C isotherms (Hirth 1971). Green turtles were traditionally highly prized for their flesh, fat, eggs, and shell, and fisheries in the United States and throughout the Caribbean are largely to blame for the historical decline of the species.

In the western Atlantic, several major nesting assemblages have been identified and studied (Peters 1954, Carr and Ogren 1960, Parsons 1962, Pritchard 1969, Carr *et al.* 1978). The largest, at Tortuguero, Costa Rica, has shown a long-term increasing trend since monitoring began in 1971. The increase is from an annual fitted-estimated number of emergences of under 20,000 in 1971 to over 40,000 in 1996. Over 100,000 emergences occurred in 1995 (Bjorndal *et al.* 1999b). In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart 1979). Occasional nesting has been documented along the Gulf coast of Florida, at southwest Florida beaches, as well as the beaches on the Florida Panhandle (Meylan *et al.* 1995). Most documented green turtle nesting activity occurs on Florida index beaches, which were established to standardize data collection methods and survey effort on key nesting beaches. The pattern of green 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, perhaps due to increased protective legislation throughout the Caribbean (Meylan *et al.* 1995). A long-term in-water monitoring study in the Indian River Lagoon of Florida has tracked the populations of juvenile green turtles in a foraging environment and noted significant increases in catch-per-unit effort (more than doubling) between the years 1983-85 and 1988-90. An extreme, short-term increase in CPUE of ~300% was seen between 1995 and 1996 (Ehrhart *et al.* 1996).

Green turtles are herbivores, and feed primarily on sea grasses and macroalgae in shallow bays, lagoons, and reefs (Rebel 1974). Some of the principal feeding pastures in the Gulf of Mexico include inshore south Texas waters, the upper west coast of Florida, and the northwestern coast of the Yucatan Peninsula. Additional important foraging areas in the western Atlantic include Florida, Florida Bay, Florida Keys, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Miskito coast of Nicaragua, the Caribbean coast of Panama, and scattered areas along Colombia and Brazil (Hirth 1971). The preferred food sources in these areas are *Cymodocea, Thalassia, Zostera, Sagittaria,* and *Vallisneria* (Babcock 1937, Underwood 1951, Carr 1952, 1954).

Green turtles were once abundant enough in the shallow bays and lagoons of the Gulf of Mexico to support a commercial fishery, which landed over one million pounds of green turtles in 1890 (Doughty 1984). Doughty reported that the decline in the turtle fishery throughout the Gulf of Mexico occurred by 1902. Currently, green turtles are uncommon in offshore waters of the northern Gulf, but abundant in some inshore embayments. Shaver (1994) live-captured a number of green turtles in channels entering into Laguna Madre, in South Texas. She noted the abundance of green turtle strandings in Laguna Madre inshore waters and opined that the turtles may establish residency in the inshore foraging habitats as juveniles. Algae along the jetties at entrances to the inshore waters of South Texas was thought to be an important food source for green turtles tracked via radio-telemetry (Renaud *et al.* 1995). Transmitter-equipped turtles remained near jetties for most of the tracking period. This project was restricted to late summer months, and therefore may reflect seasonal influences. Coyne (1994) observed increased movements of green turtles during warm water months.

3.9 Hawksbill sea turtle

The hawksbill sea turtle is relatively uncommon in the waters of the continental United States, preferring coral reefs, such as those found in the Caribbean and Central America. Hawksbills feed primarily on a wide variety of sponges but also consume bryozoans, coelenterates, and mollusks. Nesting areas in the western U.S. North Atlantic include Puerto Rico and the Virgin Islands. NMFS has designated the coastal waters surrounding Mona and Monito Islands, off the west coast of Puerto Rico, as critical habitat for hawksbills. Mona Island supports the largest population of nesting hawksbills in the U.S. Caribbean. In the northern Gulf of Mexico, a surprising number of small hawksbills are encountered off Texas. Most of the Texas records are probably in the 1-2 year class range. Many of the individuals captured or stranded are unhealthy or injured (Hildebrand 1983). The lack of sponge-covered reefs and the cold winters in the northern Gulf of Mexico probably prevent hawksbills from establishing a strong presence in that area. In the wider Caribbean, hawksbill populations are reported to be declining or depleted in 22 of the 26 geopolitical units forwhich some status and trend information is available. The only populations considered to be increasing in size are those of Mexico and Mona Island, Puerto Rico (Meylan 1999).

3.10 Kemp's ridley turtle

Of the seven extant species of sea turtles of the world, the Kemp's ridley sea turtle has declined to the lowest population level. The recovery plan for the Kemp's ridley sea turtle (USFWS and NMFS 1992b) contains a description of their natural history, taxonomy, and distribution. Kemp's ridleys nest in daytime aggregations known as arribadas, primarily at Rancho Nuevo, a stretch of beach in Mexico. Most of the population of adult females nest in this single locality (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the early 1970s, the world population estimate of mature female Kemp's ridleys had been reduced to 2,500-5,000 individuals. The population declined further through the mid-1980s. Recent observations of increased nesting suggest that the decline in the ridley population has stopped and there is cautious optimism that the population is now increasing.

The nearshore waters of the Gulf of Mexico provide important developmental habitat for juvenile Kemp's ridleys. Ogren (1988) suggests that the Gulf coast, from Port Aransas, Texas, through Cedar Key, Florida, represents the primary habitat for subadult ridleys in the northern Gulf of Mexico. Stomach contents of Kemp's ridleys along the lower Texas coast consisted of a predominance of nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards (Shaver 1991). Analyses of stomach contents from sea turtles stranded on upper Texas beaches suggest similar nearshore foraging behavior (Plotkin pers. comm.).

Research being conducted by Texas A&M University has resulted in the intentional live-capture of hundreds of Kemp's ridleys at Sabine Pass and the entrance to Galveston Bay. Between 1989 and 1993, 50 of the Kemp's ridleys captured were tracked (using satellite and radio telemetry) by biologists with the NMFS Galveston Laboratory. The tracking study was designed to characterize sea turtle habitat and to identify small and large scale migration patterns. Preliminary analysis of the data collected during these studies suggests that subadult Kemp's ridleys stay in shallow, warm, nearshore waters in the northern Gulf of Mexico until cooling waters force them offshore or south along the Florida coast (Renaud, NMFS Galveston Laboratory, pers. comm.).

In recent years, unprecedented numbers of Kemp's ridley carcasses have been reported from Texas and Louisiana beaches during periods of high levels of shrimping effort. NMFS established a team of population biologists, sea turtle scientists, and managers, known as the Turtle Expert Working Group (TEWG) to conduct a status assessment of sea turtle populations. Analyses conducted by the group have indicated that the Kemp's ridley population is in the early stages of recovery; however, strandings in some years have increased at rates higher than the rate of increase in the Kemp's population (TEWG 1998). While many of the stranded turtles observed in recent years in Texas and Louisiana are believed to have been incidentally taken in the shrimp fishery, other sources of mortality exist in these waters. These stranding events illustrate the vulnerability of Kemp's ridley and loggerhead turtles to the impacts of human activities in nearshore Gulf of Mexico waters.

The TEWG (1998) developed a population model to evaluate trends in the Kemp's ridley population through the application of empirical data and life history parameter estimates. Model results identified three trends in benthic immature Kemp's ridleys. Benthic immatures are those turtles that are not yet reproductively mature but have recruited to feed in the nearshore benthic environment, where they are available to nearshore mortality sources that often result in strandings. Benthic immature ridleys are estimated to be 2-9 years of age and 20-60 cm in length. Increased production of hatchlings from the nesting beach beginning in 1966 resulted in an increase in benthic ridleys that leveled off in the late 1970s. A second period of increase, followed by leveling, occurred between 1978 and 1989. Hatchling production was further enhanced by the cooperative program between the U.S. Fish and Wildlife Service and Mexico's Instituto Nacional de Pesca to increase nest protection. A third period of steady increase, which has not leveled off to date, has occurred since 1990 and appears to be due to the greatly increased hatchling production and an apparent increase in survival rates of immature turtles beginning in 1990 due, in part, to the introduction of TEDs. Adult female ridley numbers have now grown from a low of approximately 1,050 females producing 702 nests in 1985, to greater than 3,000 females producing 1,940 nests in 1995, to greater than 9,000 females producing about 5,800 nests in 2000.

The TEWG (1998) was unable to estimate the total population size and current mortality rates for the Kemp's ridley population; however, the TEWG listed a number of preliminary conclusions. The TEWG indicated that the Kemp's ridley population appears to be in the early stage of exponential expansion. Over the period 1987 to 1995, the rate of increase in the annual number of nests accelerated in a trend that would continue with enhanced hatchling production and the use of TEDs. Nesting data indicated that the number of adults declined from a population that produced 6,000 nests in 1966 to a population that produced 924 nests in 1978 and a low of 702 nests in 1985. Thus, the trajectory of adult abundance tracks trends in nest abundance from an estimate of 9,600 in 1966 to 1,050 in 1985. The TEWG estimated that in 1995 there were 3,000 adult ridleys. The increased recruitment of new adults is illustrated in the proportion of neophyte, or first time nesters, which has increased from 6% to 28% from 1981 to 1989 and from 23% to 41% from 1990 to 1994. The TEWG determined that the data reviewed suggested that adult Kemp's ridley turtles were restricted somewhat to the Gulf of Mexico in shallow near shore waters, and benthic immature turtles of 20-60 cm straight line carapace length are found in nearshore coastal waters including estuaries of the Gulf of Mexico and the Atlantic.

The TEWG (2000) identified an average Kemp's ridley population growth rate of l1.3% per year (95% C.I.. slope = 0.096-0.130) since 1985. Increase in hatchling production from 1985-1998 was slightly less, 9.5% per year. The 1996 and 1997 nest numbers reflected a slower rate of growth, while the increase in the 1998 nesting level was much higher, then decreased in 1999, and increased again strongly in 2000. The population growth rate does not appear as steady as originally forecasted by the TEWG, but annual fluctuations, due in part to irregular remigration intervals, are normal for other sea turtle populations.

Given 2.5 nests per female, if the population continues to grow at 9.6-13% per year, it is projected to reach the target of 10,000 nesting females around 2014-2025 (TEWG 2000).

The area surveyed for ridley nests in Mexico was expanded in 1990 due to degradation of the primary nesting beach by Hurricane Gilbert. The TEWG (1998) assumed that the increased nesting observed particularly since 1990 was a true increase, rather than the result of expanded beach coverage. Because systematic surveys of the adjacent beaches were not conducted prior to 1990, there is no way to determine what proportion of the nesting increase documented since that time is due to the increased survey effort rather than an expanding ridley nesting range. The annual rate of increase of nests at Ranch Nuevo, only from 1985-1999, is 7.9% per year. It is uncertain whether the current rate of increase will continue. As noted by TEWG, trends in Kemp's ridley nesting even on the Rancho Nuevo beaches alone suggest that recovery of this population has begun but continued caution is necessary to ensure recovery and to meet the goals identified in the Kemp's Ridley Recovery Plan (TEWG 2000).

3.11 Critical Habitat (Northern Right Whale)

The nearshore waters of northeast Florida and southern Georgia were formally designated as critical habitat for right whales on June 3, 1994 (59 FR, 28793). These waters were first identified as a likely calving and nursery area for right whales in 1984. Since that time, Kraus *et al.* (1993) have documented in this area the occurrence of 74 % of all the known mature females from the North Atlantic population. While sightings off Georgia and Florida include primarily adult females and calves, juveniles and adult males have also been observed.

There are 5 well-known habitats used annually by right whales, including (1) coastal Florida and Georgia, (2) the Great South Channel, east of Cape Cod, (3) Cape Cod and Massachusetts bays, (4) the Bay of Fundy and, (5) Browns and Baccaro Banks, south of Nova Scotia. The first 3 areas occur in U.S. waters and have been designated by NMFS as critical habitat (59 FR, 28793). With the exception of the southeast U.S. shark gillnet fishery (which is now prohibited from operating within the southeastern critical habitat area during the season when right whales are in the area), HMS fisheries do not generally co-occur in time and space with these critical habitat areas. However, the AOCTRP recommends that NMFS implement regulations prohibiting pelagic longline gear from being deployed in right whale critical habitat areas. Although the current lack of such fisheries in these areas is due to the lack of concentrations of target HMS fish species, NMFS should strive to implement this recommendation in the near future to ensure against potential changes to the current situation.

3.12 Factors Affecting Sea Turtles and Large Whales in the Atlantic Ocean

The slow moving right whale appears to be more vulnerable to both vessel strikes and fishery interactions than other whale species. Other differences between species generally relate to distributional differences. For example, offshore species such as sperm, sei, and blue whales, or leatherback sea turtles, may encounter human activities less often than more coastally distributed species such as right and humpback whales. Some discrimination is evident between whale and sea turtle species. For example, they have different susceptibilities to ship strikes and entanglement in fishing gear. Other aspects such as marine pollution likely cross taxonomic boundaries between reptiles and mammals. The previous section detailed some of these differences and below is a description of fisheries and non-fisheries related threats to sea turtles and whales in the Atlantic Ocean. These are categorized into federally permitted activities (these would require section 7 consultations and include 14 federal fisheries, 1 Atlantic States Marine Fisheries Commission (SMFC) fishery, 4 power plants, numerous Section 10 permits for scientific research and incidental take, FWS permitted activities on beaches (*e.g.*, beach nourishment, construction, sea turtle work), state permitted activities (includes Section 10 permits), non-permitted activities which include state fisheries, boat strikes, poaching, beach and coastal lighting, marine debris, and foreign activities (fishing with longline, gillnet, set net, hook and line, trawls, harpoon/spear, and beach seines). Information/data available on loggerhead and leatherback sea turtle interactions relative to these activities is available in Appendix II of the NMFS SEFSC (2001) report (attached).

3.12.1 Federal Actions

In recent years, NMFS has undertaken several ESA section 7 consultations to address the effects of vessel operations and gear associated with federally-permitted fisheries on threatened and endangered species in the action area. Each of those consultations sought to develop ways of reducing the probability of adverse effects of the action on large whales and sea turtles. Similarly, recovery actions NMFS has undertaken under both the MMPA and the ESA are addressing the problem of take of whales in the fishing and shipping industries. Estimates of incidental take of sea turtles for federal actions considered in previous Opinions are summarized briefly in the following pages and in NMFS (2001a). The following summary of anticipated incidental take of turtles includes only those federal actions which have undergone formal section 7 consultation.

3.12.1.1 Vessel Operations

Federal vessel operations in the action area which may interact with listed species include those associated with operations of the U.S. Navy (USN) and U.S. Coast Guard (USCG) - which maintain the largest federal vessel fleets, the Environmental Protection Agency (EPA), NOAA, and the U.S. Army Corps of Engineers (COE). NMFS has identified measures to minimize interactions with listed species during formal consultations with the USCG, USN, and COE, and is currently in early phases of consultation with the other federal agencies on their vessel operations. NMFS has also included restrictions on operations of contract or private vessels associated with COE dredging operations, which minimize and/or avoid interactions with listed whales and turtles.

With these measure in place, NMFS anticipated that no incidental take of listed whales, and only one or two sea turtles, would occur annually incidental to the USCG and USN vessel operations. Since the USN consultation only covered operations out of Mayport, Florida, and the USCG consultation did not cover operations in the Gulf of Mexico, NMFS has not yet been requested to consult on the effects of USN or USCG vessels interacting with large whales and sea turtles when they are operating in other areas within the action area of the HMS Pelagic Fishery. NMFS has not consulted on operations of vessels by other federal agencies within the action area (NOAA, EPA, COE) which are engaged in research and/or other activities, with the exception of Section 7 consultations completed for research permits.

Through the section 7 process, where applicable, NMFS has and will continue to recommend measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. For the purposes of this consultation, NMFS anticipates that vessels operated by these federal agencies will continue to operate in the action area with potential for some level of interaction with listed species. Based on information provided concerning those activities which have undergone section 7 consultation, most of these interactions are not expected to result in injury or harm. Those vessels operating in compliance with NMFS' recommendations are assumed to significantly avoid and/or minimize the potential for interactions with listed species. Refer to the Opinions for the USCG (NMFS 1995, 1996b, and 1998) and the USN (NMFS 1997a) for detail on the scope of vessel operations for these agencies and conservation measures being implemented as standard operating procedures.

Therefore, while this may have been more of a source of mortality in previous years, very little impact is expected on either sea turtles or whales from the activities already covered under Section 7 in the foreseeable future. Vessel operations outside federal consultation requirements are being addressed through other means that will be discussed later (*e.g.*, private vessel traffic and large whale implementation teams).

3.12.1.2 Military operations

Military operations include vessel operations and ordnance detonation, that may also adversely affect listed species of whales and sea turtles. NMFS' 1997 Opinion on USN aerial bombing training in the ocean off the southeast U.S. coast, involving live ordnance (500 and 1,000-lb bombs), anticipated that up to 84 loggerheads, 12 leatherbacks, and 12 greens or Kemp's ridley, in combination, may be injured or killed annually during testing activities (NMFS 1997a).

The USN has is conducting a one-time ship-shock test for the new SEA WOLF submarine off the Atlantic coast of Florida, using 5 submerged detonations of 10,000-lb explosive charges. The test is estimated to injure or kill 50 loggerheads, 6 leatherbacks, and 4 hawksbills, greens, or Kemp's ridleys, in combination (NMFS 1996b). The USN has also proposed to conduct a one-time ship-shock testing in summer 2001 on the DDG-81 WINSTON CHURCHILL, using 4 submerged detonations of 10,000-lb explosive charges. NMFS has anticipated that this testing may lethally take up to 8 sea turtles, and take up to 228 sea turtles by acoustic harassment (NMFS 2000b).

3.12.1.3 Dredging activities

Dredging associated with the construction and maintenance of federal navigation channels has also been identified as a source of mortality to sea turtles. Although listed whales may detect dredging activities, they are not likely to interact with the dredge operations. Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore borrow areas, move relatively rapidly (compared to sea turtle swimming speeds) and can entrain and kill sea turtles, presumably as the drag heads are lifted off the bottom with the dredge pumps still running which entrains turtles from the water column.

U.S. Navy northeast operations requiring dredging at the Dam Neck Naval Facility may take 10 loggerhead, 1 green and 1 Kemp's ridley. Along the Atlantic coast of the southeastern United States, NMFS estimates that annual, observed injury or mortality of sea turtles from hopper dredging associated with COE activities may reach 35 loggerheads, 7 greens, 7 Kemp's ridleys, and 2 hawksbills (NMFS 1997b).

Along the north and west coasts of the Gulf of Mexico, COE channel maintenance dredging using a hopper dredge may injure or kill 30 loggerhead, 8 green, 14 Kemp's ridley, and 2 hawksbill sea turtles annually (NMFS 1997c). For the eastern Gulf of Mexico, those numbers are 8 loggerhead, 5 leatherback,5 green, 5 Kemp's and 5 hawksbill. In the Northeast Atlantic, COE dredging activities are expected to lethally take 29 loggerhead, 2 leatherback, 7 green, and 6 Kemp's ridley.

In most areas of the United States, annual dredging to accommodate commercial shipping occurs in the nearshore approaches to most of the major ports. Dredging may pose a threat to whales due to increased vessel traffic. Dredge vessels move back and forth between dredging and dumping sites; although, these vessels in general are relatively slow moving. Under ESA section 7 consultations conducted on various dredging activities, various measures to mitigate this concern have been implemented, including posting of dedicated whale observers in high whale-use areas and seasons. Additionally, dredging may result in increased vessel traffic as deepening and/or widening of ports or channels attracts more and larger vessels to use these areas. Dredging is responsible for injury and mortality of sea turtles and is also mitigated for in many ways under various Opinions conducted on these activities.

COE and Minerals Management Service (MMS) rig removal activities also adversely affect sea turtles. For the COE activities, an incidental take (by injury or mortality) of 1 documented Kemp's ridley, green, hawksbill, leatherback, or loggerhead turtle is anticipated under a rig removal consultation for the New Orleans District (NMFS 1998b). MMS activities are anticipated to result in annual incidental take (by injury or mortality) of 30 sea turtles, including no more than 5 Kemp's ridley, green, hawksbill, or leatherback turtles and no more than 10 loggerhead turtles, due to MMS' OCS oil and gas exploration, development, production, and abandonment activities.

3.12.1.4 Domestic Federal Fishery Operations

Fishing operations using a variety of gear are known to interact with threatened and endangered species in the action area. Efforts to reduce the adverse effects of commercial fisheries are addressed through both the MMPA take reduction planning process and the ESA section 7 process. Longline, gillnet, set net, hook and line, trawls, harpoon/spear, pot gear, pound nets, fish traps and beach seines have been documented interacting with either whales or sea turtles or both. Since the federal fisheries are managed by NMFS, NMFS' Office of Sustainable Fisheries is required to complete section 7 consultations on decision to approve FMPs which may affect listed species. Following completion of formal section 7 consultation, NMFS' Office of Protected Resources has issued biological opinions for the following fisheries: American Lobster, Monkfish, Dogfish, Northeast Multispecies, Tilefish, Bluefish, Squid/Mackerel/Butterfish, Surf Clam/Ocean Quahog, and Summer Flounder/Scup/ Black Sea Bass, Weakfish, Herring, and Sargassum fisheries in the action area. These consultations are summarized below; for more detailed information, refer to the respective Opinions.

The *Northeast Multispecies Sink Gillnet Fishery* is one of the other major fisheries in the action area of this consultation that is known to entangle whales and sea turtles. This fishery has historically occurred from the periphery of the Gulf of Maine to Rhode Island in water to 60 fathoms. In recent years, more of the effort in this fishery has occurred in offshore waters and into the Mid-Atlantic. Participation in this fishery declined from 399 to 341 permit holders in 1993, and is expected to continue to decline as further groundfish conservation measures are implemented. The fishery operates throughout the year with peaks in the spring and from October through February. Data indicate that gear used in this fishery has seriously injured right whales, humpback whales, fin whales, and loggerhead, leatherback and Kemp's ridley sea turtles. Waring *et al.* (1997) reports that 17 serious injuries or mortalities of humpback whales from 1991 to 1996 were fishery interactions (not necessarily multispecies gear). Most implicated some kind of monofilament similar to that used in the multispecies fishery. Incidental lethal take levels of turtles anticipated in this fishery are 10 loggerhead, 4 leatherback, 4 green, and 2 Kemp's ridley. It is often difficult to assess gear found on stranded animals or observed at sea and assign it to a specific fishery. Only a fraction of the takes are observed, and the catch rate represented by the majority of takes, which are reported opportunistically, *i.e.*, not as part of a random sampling program, is unknown. Consequently, the total level of interaction cannot be determined through extrapolation. Based on new information regarding the status of right whales and sea turtle interactions, NMFS reinitiated consultation on the Multispecies FMP on May 4, 2000. The new Opinion will evaluate the effects of this fishery on listed species and provide new estimates of incidental take.

The *American Lobster Pot Fishery* is the largest fixed gear fishery in the action area. This fishery is known to take endangered whales and sea turtles. In 1998, NMFS reinitiated formal consultation on the federally regulated lobster fishery to consider potential effects of the transfer of management authority from the MSA to the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA), the implementation of new lobster management actions under the ACFCMA, and recent takes of endangered whales in the fishery. The previous formal consultation on the fishery under the MSA (Opinion issued December 13, 1996) had reached a jeopardy conclusion for the northern right whale. As a result of the RPA included with the 1996 Opinion, an emergency regulation under the MMPA (Emergency Interim Final Rule, 62 FR 16108) was published implementing restrictions on the use of lobster pot gear in the federal portion of the Cape Cod Bay right whale critical habitat and in the Great South Channel right whale critical habitat during periods of expected peak right whale abundance.

The proposed ACFCMA plan contains measures to limit the number of lobster traps that can be deployed during the first two years of the plan, and further trap reduction measures may be chosen as default effort reduction measures during subsequent plan years. The reduction in the number of traps fished is expected to result in a reduction of entanglement risk. The interaction between the lobster trap fishery and endangered whales is addressed in the ALWTRP implemented via an interim final rule November 15, 1997, followed by a final rule issued February 16,1999. The ALWTRP incorporated the RPA issued with the 1996 Opinion and implemented additional restrictions. Because of the greater protection provided by the ALWTRP, NMFS substituted the ALWTRP for the RPA issued with the 1996 Opinion and has concluded that the lobster fishery in the context of the ALWTRP is likely to adversely affect but is not likely to jeopardize the northern right whale. As with the multispecies Opinion noted above, the level of incidental take anticipated for this fishery was incorporated within the July 5, 1989, Opinion on the Issuing of Exemptions for Commercial Fishing Operations under Section 114 of the MMPA, as detailed above (NMFS 1989). Due to new information on the status of right whales and sea turtle interactions, NMFS reinitiated consultation on this fishery on June 22, 2000. The new Opinion will evaluate the effects of this fishery on listed species and provide new estimates of incidental take. The existing opinion anticipates lethal take of 10 loggerhead and 4 leatherback sea turtles.

The *Monkfish Fishery Management Plan* was prepared by the New England and Mid-Atlantic Fishery Management Councils. This fishery uses several gear types which may entangle protected species, and takes of shortnose sturgeon and sea turtles have been recorded from monkfish trips. The monkfish gillnet sector is included in either the northeast sink gillnet or mid-Atlantic coastal gillnet fisheries and is therefore regulated by the ALWTRP and the Harbor Porpoise Take Reduction Plan. NMFS completed a formal consultation on the Monkfish FMP on December 21, 1998, which concluded that the fishery, with modification under the take reduction plans, is not likely to jeopardize listed species or adversely modify critical habitat. The incidental take statement (ITS) provided under this Opinion anticipates up to 6 incidental takes of loggerhead turtles (no more than 3 lethal), 1 lethal or non-lethal take of a green sea turtle, 1 lethal or non-lethal take of a Kemp’s ridley, and 1 lethal or non-lethal take of a leatherback. However, based on the potential involvement of this fishery in the recent pulse of sea turtle strandings in North Carolina, noted elsewhere in this Opinion, as well as new information on the status of right whales and sea turtle interactions, NMFS reinitiated consultation on the Monkfish FMP on May 4, 2000. The new Opinion will evaluate the effects of this fishery on listed species and provide new estimates of incidental take.

The *Spiny Dogfish Fishery* is similar to the monkfish fishery, but uses somewhat smaller mesh gear. The most recent Opinion prepared for the FMP for this fishery anticipated 6 takes (no more than 3 lethal) of loggerheads, and 1 take (lethal or non-lethal) each for Kemp's ridley, leatherbacks and green sea turtles. Due to new information on the status of right whales and sea turtle interactions, NMFS also reinitiated consultation on the Spiny Dogfish FMP on May 4, 2000. The new Opinion will evaluate the effects of this fishery on listed species and provide new estimates of incidental take.

NMFS recently completed consultation on a new FMP for the *Tilefish fishery* on March 13, 2001. Tilefish are primarily taken by bottom longline gear; although, bottom trawl gear is also utilized. Although sperm whales have been documented in bottom longline gear in fishing areas outside of the action area, NMFS does not anticipate any listed whales will be taken in this fishery. Based on information from fisheries using similar gears in the action area, NMFS anticipated that up to 6 loggerheads and 1 leatherback sea turtle may be incidentally captured in bottom longline or trawl gears associated with the tilefish fishery on an annual basis.

The *Bluefish Fishery* operates in the action area using a combination of gillnets (48%), otter trawls (19%), fish pound nets (7%), hand and troll lines (6%), and haul seines (3%). Based on observations of incidental take of listed species in other fisheries using similar gear types, NMFS anticipated in its July 2, 1999, Opinion that up 6 loggerhead and 6 Kemp's ridley sea turtles may be taken on an annual basis in the bluefish fishery.

The *Squid/Mackerel/Butterfish Fishery* uses primarily midwater and bottom trawl gear, although pelagic drift gillnet, pelagic longline/hook-and-line/hand line, purse seine, pot, trap, dredge, pound nets, and bandit gears are all approved for use under the FMP. NMFS' April 28, 1999, Opinion anticipated that up to 6 loggerhead, 2 green or Kemp's ridley, and 1 leatherback sea turtle could be incidentally captured in the squid/mackerel/butterfish fishery.

The *Summer Flounder, Scup and Black Sea Bass Fisheries* are known to interact with sea turtles. While not documented, the gear-types used in this fishery could also entangle endangered whales, particularly humpback whales. 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 such as scup and black sea bass), by requiring TEDs in nets in the area of greatest bycatch off the North Carolina and southern Virginia coast. NMFS is considering a more geographically inclusive regulation to require TEDs in trawl fisheries that overlap with sea turtle distribution to reduce the impact from this fishery. Developmental work is also ongoing for a TED that will work in the flynets used in the weakfish fishery. These fisheries are subject to the requirements of the ALWTRP for gillnets and lobster pots in the Mid-Atlantic. The anticipated observed annual take rates for turtles in this multispecies fishery is 15 loggerheads and 3 leatherbacks, hawksbills, greens, or Kemp's ridley, in combination annually (NMFS 1997a).

The *Southeast U.S. Shrimp Fishery* is known to incidentally take high numbers of sea turtles. Henwood and Stuntz (1987) reported that the mortality rate for trawl-caught turtles ranged between 21% and 38%, although Magnuson *et al.* (1990) suggested Henwood and Stuntz's estimates were very conservative and likely an underestimate of the true mortality rate. Since 1990, shrimp trawlers in the southeastern U.S. are required to use TEDs, which optimally reduce a trawler's capture rate by 97%. Even so, NMFS estimated that 4,100 turtles may be taken lethally or non-lethally annually by shrimp trawlers operating legally under the sea turtle conservation measures, including 650 leatherbacks too big to be released through TEDs, 1,700 turtles taken in try nets, and 1,750 turtles (representing a 3% capture rate) that fail to escape through the TED (NMFS, 1998d), including large loggerheads. A detailed summary of the U.S. shrimp trawl fishery and the Mid-Atlantic winter trawl fishery impacts can be found in the TEWG reports (1998, 2000).

A large proportion of stranded loggerheads and a small proportion of stranded green turtles appear too large to fit through the required minimum-sized TED openings in the shrimp trawl fishery and thus it is likely that current TEDs have not achieved 97% reduction in capture of large loggerheads and greens, and most leatherbacks. The relatively large proportion of stranded loggerhead turtles with dimensions greater than the required minimum TED height opening is cause for concern in light of the need to reduce mortality on the northern subpopulation of loggerheads (TEWG 1998). Strandings of loggerhead turtles with body depths greater than the currently required minimum TED height opening has ranged between 33% and 47% of the total measured strandings since 1986. In the 3 years preceding September 1999, nearly 1,300 stranded loggerhead turtles were deeper bodied than the currently required TED height opening. The problem is acute off the nesting beaches of the eastern Gulf of Mexico and the Atlantic seaboard (Epperly and Teas 1999). It is also noteworthy that, on average, the number of turtle carcasses stranded on ocean-facing beaches may represent, at best, based on evidence obtained via a 3-dimensional oceanographic model (Werner *et al.* 1999), approximately 20% of the total number of available carcasses at sea (*i.e.*, of turtles dying at sea). Only those turtles killed very close to the shore may be most likely to strand (*in* NMFS SEFSC 2001). NMFS has recently reinitiated consultation on the *Southeast U.S. Shrimp Fishery* to consider a new TED regulation proposed April 5, 2000, to increase the size of openings and reduce mortalities of captured sea turtles.

The *Atlantic Herring Fishery* operating in the northeastern U.S. was issued a biological opinion that anticipates 6 loggerhead takes of which no more than 3 would be lethal, and 6 lethal takes of Kemp's ridleys.

An Opinion on the *NMFS/ASMFC Interjurisdictional FMP for Weakfish* was conducted in June 1997. Weakfish are caught in the summer flounder fishery and are also fished with flynets. Analyses of the NMFS' observer data showed 36 incidental captures of sea turtles for trawl and gillnet vessels operating south of Cape May, New Jersey from April 1994 through December 1996. Of those turtles taken, 28 loggerheads were taken in trawls that also caught weakfish, and resulted in 2 deaths. Most of the sea turtle takes occurred in late fall. In all cases, weakfish landings were second in poundage behind Atlantic croaker and summer flounder (NEFSC, unpub. data). The Opinion on the federal portion of the fishery anticipates 20 lethal takes of loggerheads and 2 lethal takes of Kemp's ridleys.

In the *Sargassum Fishery*, NMFS has also anticipated that juvenile sea turtles will be taken. In its June 21, 1999, Opinion, NMFS anticipated that up to 30 neonate/immature loggerhead and no more than 1 neonate/pelagic immature leatherback, hawksbill, green, and Kemp's ridley sea turtles will be taken on an annual basis during the harvest of *Sargassum*.

3.12.1.5 Other Federal Actions

Power Plants impact sea turtles entering coastal or inshore areas by entrainment in the cooling-water systems. At the St. Lucie nuclear power plant at Hutchinson Island, Florida, large numbers of green and loggerhead turtles have been captured in the seawater intake canal in the past several years. Annual capture levels from 1994-1997 have ranged from almost 200 to almost 700 green turtles and from about 150 to over 350 loggerheads. Almost all of the turtles are caught and released alive; NMFS estimates the survival rate at 98.5% or greater (see NMFS 1997e).

An Opinion completed in January 2000 estimates that the operations at the Brunswick Steam Electric Plant in Brunswick, North Carolina, may take 50 sea turtles in any combination annually, that are released alive. NMFS also estimated the total lethal take of turtles at this plant may reach 6 loggerhead, 2 Kemp's ridley, or 3 green turtles annually.

An Opinion completed in June 1999 on the operations at the Crystal River Energy Complex in Crystal River, Florida, estimated the level of take of sea turtles in the plant's intake canal may reach 55 sea turtles with an estimated 50 being released alive biennially. Opinions were also issued for the Oyster Creek and Salem and Hope Nuclear generating stations that anticipated 40 loggerhead takes (8 lethal), 7 Kemp's ridleys (3 lethal) and 8 greens (2 lethal).

It is important to note that the large majority of captures in power plant facilities on the U.S. east coast do not result in serious injury or mortality since most of the plants have implemented procedures specifically to release turtles unharmed.

Other federally permitted activities affecting loggerhead and leatherback sea turtles are detailed in NMFS SEFSC, 2001, Appendix II and include a number of research activities, the large majority of which are not lethal. Very little data was available from US FWS on various activities they permit based on their sea turtle jurisdiction on beaches. However, as they are also monitoring activities such as beach renourishment through Section 7 consultation, it would be expected that the impacts of such activities would be minimal.

3.12.2 State or Private Actions

3.12.2.1 Private and Commercial Vessels

Private and commercial vessels operate in the action area of this consultation and also have the potential to interact with whales and sea turtles. For example, shipping traffic in Massachusetts Bay is estimated at 1,200 ship crossings per year with an average of 3 per day. More than 280 commercial fishing vessels fish on Stellwagen Bank in the Gulf of Maine, and sportfishing contributes more than 20 vessels per day from May to September. In Massachusetts Bay alone, about 20 whale watch companies representing 40-50 boats conduct several thousand trips from April to September, with the majority of effort in the summer season. More than 280 commercial vessels fish on Stellwagen Bank. Sportfishing contributes more than 20 vessels per day from May to September. In addition, an unknown number of private recreational boaters frequent Massachusetts and Cape Cod Bays. Similar traffic and more exists for many other ports, some larger, within the scope of this consultation which overlap with whale high-use areas. The invention and popularization of new technology resulting in high speed catamarans for ferry services and whale watch vessels operating in congested coastal areas contribute to the potential for impacts from privately-operated vessels.

Various initiatives have been planned or undertaken to expand or establish high-speed watercraft service in the northwest Atlantic, including 1 service between Bar Harbor, Maine, and Nova Scotia with a vessel operating at higher speeds than established watercraft service. The Bar Harbor–Nova Scotia high speed ferry conducted its first season of operations in 1998. The operations of these vessels and other high-speed craft may adversely affect threatened and endangered whales and sea turtles, as discussed previously with private and commercial vessel traffic in the Action Area. NMFS and other member agencies of the Northeast Implementation Team for the Recovery of the Northern Right Whale will continue to monitor the development of the high speed vessel industry and its potential threats to listed species and critical habitat. Recent whale strikes resulting from interaction with whale watch boats and recreational vessels have also been recorded.

Wiley *et al.* (1995) showed that in the mid-Atlantic area (between Chesapeake Bay, Virginia, and Cape Hatteras, North Carolina), of the stranded humpback whales for which the cause of death was determinable, 30% of the mortalities were attributed to vessel strikes and 25% had injuries consistent with entanglement in fishing gear. This indicates that vessel interactions are having an impact upon whale populations along this portion of the coast, as well as in right whale concentration areas. Because most of the whales involved in these interactions are juveniles, areas of concentration for young or newborn animals are particularly important to protect. This also raises concerns that, with such mortality focused on one age class of the population, that future recruitment to the breeding population may be affected.

The ports of Jacksonville and Port Everglades, Florida; Baltimore, Maryland; Wilmington, Delaware; Philadelphia, Pennsylvania; New York, New York; and Boston, Massachusetts support some of the country's strongest maritime economies. Commercial shipping traffic in Massachusetts Bay is estimated at 1,200 ship crossings per year with an average of 3 per day. About 17 million tons of waterborne cargo pass through the Port of Jacksonville, Florida which receives about 1,600 vessels each year moving between the U.S. and South America, Europe, and the Caribbean. About 4.8 million tons (short tons) pass through the Port of Wilmington, Delaware which receives about 400 vessels each year. About 56 million tons of waterborne cargo passed through the Port of New York in 1998. About 1.3 million tons of general cargo, 1.5 million tons of bulk cargo, and 12.8 million tons of bulk fuel cargo pass through the Port of Boston, Massachusetts, which receives more than 62 ship calls, 350 container vessels, and 1,700 bulk cargo vessels each year. In addition, about 60 cruise vessels sail from the Port of Boston each year. (Note: data derived from the internet websites of each of the named ports)

In southeastern waters, shipping channels associated with Jacksonville and Port Canaveral, Florida, bisect the area that contains the most concentrated whale sightings within right whale critical habitat. These channels and their approaches serve commercial shipping ports and two military bases. All of these channels require periodic maintenance dredging by the COE (and at times, more extensive dredging is conducted to support port expansion or to allow for larger military vessels). These commercial ports are growing, with the port of Jacksonville, one of the busiest ports on the east coast, undergoing major expansion along with several other east coast ports vying for designation as "megaports" to attract Panamanian ex-vessel traffic. Expansion of these ports requires section 7 consultations.

In addition to commercial traffic and recreational pursuits, private vessels participate in high- speed marine events concentrated in the southeastern United States that are a particular threat to sea turtles, and occasionally to marine mammals as well. The magnitude of these marine events is not currently known. NMFS and the USCG are in early consultation on these events, but a thorough analysis has not been completed. The Sea Turtle Stranding and Salvage Network (STSSN) also reports many records of vessel interaction (propeller injury) with sea turtles off coastal states such as New Jersey and Florida, where there are high levels of vessel traffic.

Ship strikes have been identified as a significant source of mortality to the Western Atlantic stock of right whales (Kraus 1990) and are also known to impact all other endangered whales. Specifically, commercial and private vessels may affect humpback, fin, sperm, and right whales. Small vessel traffic also kills or injures threatened and endangered sea turtles in the action area. NMFS expects this commercial traffic into and out of these ports to continue into the foreseeable future. The best scientific and commercial data available provide no specific information on what risk this level of commercial traffic poses to endangered whales in the action area, but NMFS would expect this level of commercial traffic to pose a risk of ship strikes that would continue to kill or seriously injure whales in numbers similar to those observed between 1994 and 1999 (1 dead blue whale, 1 dead sei whale, 2 dead fin whales, and at least 6 dead right whales).

3.12.2.2 State Fishery Operations

Several coastal state fisheries are known to incidentally take listed species, but information on these fisheries is sparse (NMFS 2001a). Although few of these state regulated fisheries are currently authorized to incidentally take listed species, several state agencies have approached NMFS to discuss applications for a section 10(a)(1)(B) incidental take permit. Since NMFS' issuance of a section 10(a)(1)(B) permit will require formal consultation under section 7 of the ESA, the effects of these activities will be considered in future section 7 consultation. Although the past and current effects of these fisheries on listed species is currently not determinable, NMFS believes that ongoing state fishing activities may be responsible for seasonally high levels of observed strandings of sea turtles on both the Atlantic and Gulf coasts. Most of the state data is based on extremely low observer coverage or sea turtles were not part of data collection; thus, this data provides insight into gear interactions that could occur but is not indicative of the magnitude of the overall problem. The following state by state summary is based on research that is summarized in NMFS SEFSC (2001) and only records sea turtles.

It is important to recognize that these estimates are based on varied levels of observer effort (some extremely low), differences in observer program priorities, varying levels of information provided to NMFS by the states, and varying levels of sophistication in data collection and database management techniques. Therefore, these values do not provide a reliable estimate of the magnitude of take and are considered significant underestimates of actual take.

Massachusetts fisheries include: bottom trawl fishery (1 loggerhead was observed taken), lobster pot fishery (85 stranded leatherbacks linked to this fishery), pound net (weir) fishery (no data), pound net (1 leatherback was observed taken), gill net (1 loggerhead was observed taken), non-shrimp trawl (1 green was observed taken), fish trap (1 loggerhead and 1 leatherback were observed taken), hook and line (1 loggerhead was observed taken).

Rhode Island fisheries include: bottom trawl ("occasional" loggerhead), gill nets (no data), large fish traps (11 leatherbacks and 1 Kemp's ridley were reported taken), lobster pots (7 leatherback were reported taken), pound nets (2 observed leatherbacks), non-shrimp trawl (1 leatherback were observed taken).

Connecticut fisheries: no data on listed species bycatch available, but bottom trawl, gill net, and lobster pot fisheries operate in state waters.

New York: fisheries consist of bottom trawl, pound nets, gillnets, fish trap, non-shrimp trawl, lobster pot and set nets. Of these, the pound net fishery has taken 144 loggerheads, 43 Kemp's ridleys and 52 green turtles, all unharmed. There have been 12 reports of leatherback entanglements with lobster in New

York. The rest of the fisheries combined only show observed interactions of 1-2 turtles each from any number of species.

New Jersey: has a list of fisheries similar to NY, no data was available for the bottom trawl or gill net fisheries, pound net captures were observed for 16 loggerheads.

Delaware: no data were available on the horseshoe crab fishery, gillnet fishery or fish traps for sea turtle take, but 9 loggerheads and 3 greens were observed in non-shrimp trawls, 12 loggerheads in hook and line fisheries in Delaware Bay, and 2 in driftnets.

Maryland: no data were available for bottom trawl, gillnet, or hook and line fisheries operating in the state, but 4 green and 3 Kemp's ridley turtles were reportedly taken in pound net fisheries and 1 loggerhead was taken in (non-shrimp) trawl fisheries.

Virginia: the pound net fishery has 82 observed loggerhead takes (1 dead) and 6 green (0 dead), hook and line, non-shrimp trawl and gill net fisheries records show 1-2 observations of loggerhead takes. According to NMFS records for the Marine Mammal Exemption Program, which governed marine mammal/fishery interactions prior to the 1994 amendments to the MMPA, interactions between humpback whales and menhaden purse seines have occurred in the past. It is not known whether injury or mortality resulted nor where the interactions occurred.

North Carolina: the pound net fishery has been observed for years and has probably some of the most complete data; a total of 2898 loggerheads were estimated to have been caught (156 observed), 0 were dead, 531 estimated ridleys, and 221 estimated greens. Hook and line fishery observed takes are 70 loggerheads, 1 leatherback, 3 Kemp's ridley, 22 green, 0 dead; seine and long haul seine net observations included 15 loggerheads, 1 Kemp's ridley; the next highest fisheries are the shrimp trawl (22 loggerheads, 2 dead; 2 Kemp's ridley and 5 green); and non -shrimp trawls which also had observations of loggerheads (53, 6 dead). No data on sea turtles takes were available on beach seine fisheries, stop net fishery, purse seine fishery, fish traps, eel pots, shrimp pots; although, observed takes of humpback whales have been recorded by NEFSC in the beach seine fishery. Crab pot fisheries and pelagic longline had a few observations of sea turtle takes. Gillnet fisheries in North Carolina are diverse and extensive, and include a large recreational component in addition to the commercial component. One humpback whale mortality was documented in a sink gillnet targeting spot and croaker.

South Carolina has relatively few fisheries: gillnet, whelk trawling, hook and line and shrimp trawl. Few data are available regarding interactions between listed species and these fisheries. The gillnet fishery includes a small shad fishery which is phasing out, and a recreational component. A few loggerheads were observed taken in both the gillnet and trawl fisheries.

Georgia also has relatively few fisheries: shrimp bait fishery, whelk fishery, blue crab fishery, shrimp trawl, hook and line, with a few loggerhead and green turtle reported as have been taken.

Florida has a long list of state fisheries including: hook and line, fish trap, try net, shrimp trawl, non-shrimp trawl, longline, cast net, and set net. These fisheries have observations of relatively few turtles, the majority loggerheads, with the exception of the hook and line fisheries which have 7 loggerhead (1 dead), 30 green and 4 Kemp's ridley in the Atlantic and 1 green, and 7 loggerhead (1 dead), 1 green and 20 Kemp's ridley in the Gulf. The set net fishery had the next largest number of observations, 12 green turtles, recorded as alive.

Alabama has shrimp trawl incidental captures, but relatively little data are available. *Mississippi* and *Louisiana* have shrimp and non shrimp trawl fisheries, and gillnets; most recorded takes are of Kemp's ridleys (12) in shrimp trawls in Louisiana.

Texas supports hook and line, gillnetcast net, seine net, set net, trotline, shrimp trawl, non-shrimp trawl, and try net fisheries. The hook and line fisheries took 387 Kemp's ridley turtles, killing 91 of them.

The most obvious conclusion from the above list of sea turtle and whale interaction reports is the paucity of data available on interactions and also the significant potential for impacts on listed species from state fisheries. This is particularly true for whales, which may carry gear long distances before they are documented as entangled, making it difficult to determine where the interaction occurred. To address these data gaps, several state agencies have initiated observer programs to collect information on interactions between listed species and certain gear types. Other states have closed nearshore waters to gear-types known to have high encounter rates with listed species. Depending on the fishery in question, many state permit holders also hold federal permits; therefore, existing section 7 consultations on federal fisheries may address some of the state fishery impacts. Impacts of state fisheries on endangered whales are being addressed, as appropriate, through the MMPA take reduction development process. For example, the ALWTRP addresses the mid-Atlantic coastal gillnet fishery, which is largely prosecuted in state waters. NMFS is also actively participating in a cooperative effort with ASMFC to standardize and/or implement programs to collect information on level of effort and bycatch in state fisheries. When this information becomes available, it can be used to refine take reduction plan measures in state waters. With regard to whale entanglements, vessel identification is occasionally recovered from gear removed from entangled animals. With this information, it is possible to determine whether the gear was deployed by a federal or state permit holder and whether the vessel was fishing in federal or state waters.

In addition to the lack of data, other trends emerge from these summaries; certain gear types may have high levels of sea turtle takes, but very low rates of serious injury or mortality. For example, the hook and line takes rarely result in death, but trawls and gillnets frequently do. Leatherbacks seem to be susceptible to a more restricted list of fisheries, while the hard shelled turtles, particularly loggerheads, seem to appear in data on almost all of the state fisheries.

In 1998, East Coast states from Maine through North Carolina began implementing regulations pursuant to the Year 1 requirements of *Amendment 3 to the Atlantic States Marine Fisheries Commission's Coastal Fishery Management Plan for American Lobster* (ASMFC 1997). The proposed federal ACFCMA plan is designed to be complementary to the ASMFC plan, and the two plans are similar in structure. Regulations will be geared toward reducing lobster fishing effort by 2005 to reverse the overfished status of the resource. States in the 6 coastal areas must implement regulations according to a compliance schedule established in Amendment 3. Effort reduction measures will be similar to those proposed in the federal ACFCMA plan. Several states have implemented trap caps for 1998. Further trap limits, which the compliance schedule requires for Area 1 and the Outer Cape Lobster Management Area in 1999, will generate some localized risk reduction for protected species in those areas. If all states elect to implement a significant trap reduction program, the overall entanglement risk would be substantially reduced. Vessels fishing in state waters will be required to comply with MMPA take reduction plan regulations designed to reduce entanglement risk to whales.

Early in 1997, the *Commonwealth of Massachusetts* implemented restrictions on lobster pot gear in the state water portion of the Cape Cod Bay critical habitat during the January 1 - May 15 period to reduce the impact of the fishery on right whales. The regulations were revised prior to the 1998 season. State regulations impact state permit holders who also hold federal permits, although effects would be similar to those resulting from federal regulations during the January 1 - May 15 period. Massachusetts has also implemented winter/spring gillnet restrictions similar to those in the ALWTRP and the MSA for the purpose of right whale and/or harbor porpoise conservation. Lobster pots are fished in areas outside of Massachusetts where sea turtles and the depleted stock of bottlenose dolphin are present. Entanglement has been documented for both species.

The North Carolina Observer program documented 33 flynet trips from November through April of 1991-1994 and recorded no turtles caught in 218 hours of trawl effort. However, a NMFS- observed vessel fished for summer flounder for 27 tows with an otter trawl equipped with a TED and then fished for weakfish and Atlantic croaker with a flynet that was not equipped with a TED. They caught 1 loggerhead in 27 TED-equipped tows and 7 loggerheads in 9 flynet tows without TEDs. In addition, the same vessel using the flynet on a previous trip took 12 loggerheads in 11 out of 13 observed tows targeting Atlantic croaker. A slight potential exists for interaction between this fishery and humpback whales, particularly in the mid-Atlantic, but no documentation of such interactions is available.

Other bottom trawl fisheries that are suspect for the incidental capture of sea turtles are the horseshoe crab fishery in Delaware (Spotila *et al.* 1998) and the whelk trawl fishery in South Carolina (S. Murphy, pers. comm. to J. Braun-Mcneill, November 27, 2000) and Georgia (M. Dodd, pers. comm. to J. Braun-McNeill, December 21, 2000). In South Carolina, the whelk trawling season opens in late winter and early spring when offshore bottom waters are > 55ºF. One criterion for closure of this fishery is water temperature: whelk trawling closes for the season and does not reopen throughout the state until 6 days after water temperatures first reach 64ºF in the Fort Johnson boat slip. Based on the South Carolina Department of Natural Resources Office of Fisheries Management data, approximately 6 days will usually lapse before water temperatures reach 68ºF, the temperature at which sea turtles move into state waters (D. Cupka, pers. comm.). From 1996-1997, observers onboard whelk trawlers in Georgia reported a total of 3 Kemp's ridley, 2 green and 2 loggerhead sea turtles captured in 28 tows for a CPUE of 0.3097 turtles/100ft net hour. As of December 2000, TEDS are required in Georgia state waters when trawling for whelk. A loggerhead was reported captured in a Florida try net (W. Teas, pers. comm.).

A detailed summary of the gillnet fisheries currently operating along the mid- and southeast U.S. Atlantic coastline, that are known to incidentally capture loggerheads, can be found in the TEWG reports (1998, 2000). Although all or most nearshore gillnetting is prohibited by state regulations in state waters of South Carolina, Georgia, Florida, Louisiana, and Texas, gillnetting in other states' waters and in federal waters does occur. Of particular concern are the nearshore and inshore gillnet fisheries of the mid-Atlantic operating in Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina state waters and/or federal waters. Incidental captures in these gillnet fisheries (both lethal and non-lethal) of loggerhead, leatherback, green and Kemp's ridley sea turtles have been reported (W. Teas, pers. comm., J. Braun-McNeill pers. comm.). In addition, illegal gillnet incidental captures have been reported in South Carolina, Florida, Louisiana and Texas (NMFS 2001a).

Georgia and South Carolina prohibit gillnets for all but the shad fishery. This fishery was observed in South Carolina for one season by the NMFS SEFSC (McFee *et al.* 1996). No takes of protected species were observed. Florida banned all but very small nets in state waters, as has the state of Texas. Louisiana, Mississippi and Alabama have also placed restrictions on gillnet fisheries within state waters such that very little commercial gillnetting takes place in southeast waters, with the exception of North Carolina.

Gillnetting activities in North Carolina associated with the southern flounder fishery have recently been implicated in large numbers of sea turtle mortalities. NMFS closed part of Pamlico Sound to the setting of gillnets targeting southern flounder in fall 1999 after the stranding of relatively large numbers of loggerhead and Kemp's ridley sea turtles on inshore beaches. NMFS also closed the waters north of Cape Hatteras to 38° N., including the mouth of the Chesapeake Bay, to large (> 6 inch stretched) mesh gillnets for 30 days in mid-May 2000 due to the large numbers of loggerhead strandings in North Carolina, and will continue to implement such proactive measures as necessary. A large proportion of these stranded loggerheads was assumed to be from the northern subpopulation. This assumption is partly supported by analyses conducted by Bass *et al.* (1999) on genetic samples collected from sea turtles stranding on U.S. Atlantic and Gulf of Mexico shores. The northern subpopulation accounted for 25-28% of the animals that stranded off the Carolinas, and 46% of the animals sampled that stranded in the northernmost area sampled, Virginia (TEWG 2000). Most recently, on October 27, 2000, the North Carolina Division of Marine Fisheries (NCDMF) closed waters in the southeastern portion of the Pamlico Sound as a result of elevated takes by the commercial large-mesh flounder gillnet fishery. The NCDMF and NMFS had just agreed on details of a section 10 permit of the ESA for the founder fishery just prior to the closure. The fishery was closed when anticipated incidental take levels were met for green sea turtles. The NCDMF estimated that there were 50 loggerheads captured at the time of closure and that 44 of those had been drowned (NMFS 2001a).

Pulses of elevated sea turtle strandings occur with regularity in the Mid-Atlantic area, particularly along North Carolina through southern Virginia in the late fall/early spring, coincident with sea turtle migrations. For example, in the end of April through early May, 2000, approximately 300 turtles, mostly loggerheads, stranded north of Oregon Inlet, North Carolina. Gillnets were found with four of the carcasses. These strandings are likely caused by state fisheries as well as federal fisheries, although not any one fishery has been identified as the major cause. Fishing effort data indicate that fisheries targeting monkfish, dogfish, and bluefish were operating in the area of the strandings. Strandings in this area represent at best, 7-13% of the actual nearshore mortality (Epperly *et al.* 1996). Studies by Bass *et al.* (1998), Norrgard (1995) and Rankin-Baransky (1997) indicate that the percentage of northern loggerheads in this area is highly over-represented in the strandings when compared to the ~ 9% representation from this subpopulation in the overall U.S. sea turtle nesting populations. Specifically, the genetic composition of sea turtles in this area is 25-54% from the northern subpopulation, 46 - 64% from the South Florida subpopulation, and 3-16% from the Yucatan subpopulation. The cumulative removal of these turtles on an annual basis would severely impact the recovery of this species.

The Sea Turtle Stranding and Salvage Network has documented record-setting levels of sea turtle strandings in North Carolina and Florida in recent years. For example, the total number of strandings in North Carolina for 1999 was 2.3 times the average annual strandings from 1980 to 1999. The total number of Kemp's ridley strandings in 1999 was 7 times the average annual for the same time period. The number of strandings in 2000 is greater than 1999 with a preliminary total of 766, including 78 Kemp's ridleys and 17 leatherbacks. During the spring of 2000, there were two stranding events involving unprecedented numbers of turtles, along the Outer Banks in Dare and Hyde counties.

During the first stranding event, a total of 71 turtles (69 loggerheads and 2 Kemp's ridleys) washed ashore on the ocean-facing beaches between Rodanthe and Ocracoke from April 14-17, 2000. There were no externally obvious signs of death on the turtles. Necropsies on 12 loggerheads and 2 Kemp's ridleys revealed that the turtles had excellent fat stores and were probably in good health prior to their deaths. A few of the turtles had been feeding on nearshore, benthic species, but most had empty guts, suggesting that they were in a migratory, rather than foraging, mode. The uniform state of decomposition of the turtles indicated that they had likely all died suddenly within a short period of time, probably no more than a few days before stranding on the beach. Large amounts of sargassum weed blew ashore, coincident with the turtle strandings, and considered indicative of the movement of warm Gulf Stream waters close to shore.

A second stranding event began on May 3. From May 3-8, approximately 209 additional sea turtles (3 Kemp's ridleys, the rest loggerheads) were found dead on ocean beaches between Oregon Inlet and Hatteras Inlet. Virtually all were severely decomposed, suggesting that they had been dead at sea for at least several days before stranding. Four of the carcasses were entangled in fishing gear: Three loggerheads carried pieces of gillnet with a mesh size of 12 inches (30.48 cm) stretched, and one loggerhead was carrying gillnet with a mesh size of 10 inches (25.4 cm) stretched.
The stranding events along the Atlantic coast represent only a fraction of the actual at-sea mortality. The causes are multiple, including state and federal fisheries, disease and cold stunning.

Pound nets are a passive, stationary gear that are known to incidentally capture loggerhead sea turtles in Massachusetts (R. Prescott pers. comm.), Rhode Island, New Jersey, Maryland (W. Teas pers. comm.), New York (Morreale and Standora 1998), Virginia (Bellmund *et al*. 1987) and North Carolina (Epperly *et al*. 2000). Although pound nets are not a significant source of mortality for loggerheads in New York (Morreale and Standora 1998) and North Carolina (Epperly *et al.* 2000), they have been implicated in the stranding deaths of loggerheads in the Chesapeake Bay from mid-May through early June (Bellmund *et al*. 1987). The turtles were reported entangled in the large mesh (>8 inches) pound net leads (NMFS 2001a).

Incidental captures of loggerheads in fish traps set in Massachusetts, Rhode Island, New York, and Florida have been reported (W. Teas, pers. comm.). Although no incidental captures have been documented from fish traps set in North Carolina and Delaware (Anon 1995), they are another potential anthropogenic impact to loggerheads and other sea turtles. Lobster pot fisheries are prosecuted in Massachusetts (Prescott 1988), Rhode Island (Anon 1995), Connecticut (Anon 1995) and New York (S. Sadove, pers. comm.). Although they are more likely to entangle leatherback sea turtles, lobster pots set in New York are also known to entangle loggerhead sea turtles. No incidental capture data exist for the other states. 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 2001a).

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 turtles have been reported by the public fishing from boats, piers, and beach, banks, and jetties and from commercial fishermen fishing for reef fish and for sharks with both single rigs and bottom longlines (NMFS 2001). A detailed summary of the known impacts of hook and line incidental captures to loggerhead sea turtles can be found in the TEWG reports (1998, 2000).

3.12.3 International Factors

3.12.3.1 International Fisheries

Humpback whales are found internationally in feeding areas in the Gulf of St Lawrence, Newfoundland & Labrador and western Greenland, as well as Iceland and northern Norway, including off Bear Island

and Jan Mayen (Waring *et al.* 2000). On their winter migration, humpbacks from the Gulf of Maine Stock are found throughout the Antillean arc, from Puerto Rico to the coast of Venezuela. Therefore, some impacts on the population could come from international sources, including shipping, fisheries, and marine pollution. Humpback whale entanglements occur in relatively high numbers in Canadian waters. Reports of collisions with fixed fishing gear set for groundfish around Newfoundland averaged 365 annually from 1979 to 1987 (range 174-813). An average of 50 humpback whale entanglements (range 26-66) were reported annually between 1979 and 1988 and 12 of 66 humpback whales that were entangled in 1988 died (Lien *et al.* 1988).

Although more coastally oriented compared to some of the large whale species, *right whales* have been reported as far north as the Scotian shelf and several long distance movements have been recorded for individuals identified off Iceland, arctic Norway, Newfoundland, the Labrador Basin, and southeast of Greenland (Waring *et al.* 2000). Consequently, as with humpbacks, some impacts on the population could come from international sources, including shipping, fisheries, and marine pollution. Right whale entanglements are known to occur in Canadian waters, although not as frequently as for humpback whales. Ship strike records in Canadian waters have occurred at 0.4 per year (based on 1994-1998 data) and for fisheries interactions 1.0 per year (Waring *et al.*, 2000). Many entanglements observed in U.S. waters may have originated in Canadian waters. Unless gear is specifically marked and such marks are documented, it is often impossible to determine the origin of the gear.

Less is known about *fin whales* and *sperm whales* than humpbacks and right whales. Waring *et al.* (2000) report that there is likely a deep ocean component to fin whale distribution, and those occurring in the U.S. Atlantic EEZ undergo migrations into Canadian waters, open ocean areas, and perhaps even subtropical or tropical regions. The sperm whales occupying the eastern U.S. Atlantic EEZ likely represents only a fraction of the total stock and their offshore distribution is thought to be commonly associated with the Gulf Stream edge and other features. Impacts in international waters in the north are probably affecting different social groupings than seen off the northeast U.S. and include more social groups of females and calves/juveniles. Whaling records include catches near West Greenland, the Azores, Madeira, Spain, Spanish, Morocco, Norway, the British Isles, and the Faroes. Because of their offshore distribution, sperm whales are less likely to be impacted overall by human activities (Waring *et al.* 2000). However, longline gear was found on a dead sperm whale, wound tightly about its jaw; its country of origin is not known.

Whale populations/stocks protected under the ESA are impacted by fisheries and ship traffic in international waters, but the magnitude is currently unquantifiable. For right, humpback and fin whales, the contribution of international impacts to the baseline are likely not as important as the coastal impacts that occur in U.S. waters (with the exception of Canada) because of the amount of time they spend in coastal U.S. and Canadian waters. Information is so sparse on sperm whales that it is difficult to speculate, but given their distribution, impacts from international sources are likely similar to U.S. impacts.

For sea turtle species in the Atlantic, international activities, particularly fisheries, are significant factors impacting populations. The U.S. and 26 other nations participate in longline fishing throughout the western North Atlantic Ocean and the relative proportion of total hooks fished by the U.S. fleet is small compared to the cumulative total hooks fished by foreign fleets. As with U.S. fleets, sea turtles are incidentally captured in foreign fleets (NMFS SEFSC 2001). Takes of pelagic juvenile loggerheads in U.S. and international longline fisheries as a whole are large and, although the mortality rate cannot be quantified, NMFS SEFSC (2001) concludes that it could alter population trends. Some information is available on international gillnet fisheries. Incidental capture in gillnets in the central Mediterranean Sea (set by Italian fishermen) took 397 loggerheads between 1981-1990, with a maximum of 73.6% mortality rate. Another study estimated 16,000 loggerheads per year with a 30% mortality. The Spanish driftnet fishery in the western Mediterranean documented 236 loggerheads between 1993-1994, one dead. There is a directed fishery for green and hawksbill turtles in Nicaragua, but an estimated 600 loggerheads are also caught each year. Leatherbacks, are also taken in Nicaragua and an estimated 1000 mature female leatherbacks are incidentally captured annually off Trinidad and Tobago with a 50 - 95 % mortality rate. Gillnets set for finfish and sharks in Belize catch sea turtles, and of 500-800 turtles sold annually in Belize, 30% may be loggerheads. Additional information on the impacts of international fisheries is found in NMFS SEFSC (2001). NMFS estimates that thousands of sea turtles of all species are incidentally caught and a proportion of them killed incidentally or intentionally annually by international activities. The impact of international fisheries is a significant factor in the baseline inhibiting sea turtle recovery.

3.12.3.2 Other International factors

Significant anthropogenic impacts threaten nesting populations of all species in areas outside of the U.S. This impacts include poaching of eggs, immatures and adults as well as beach development problems. There are other more indirect factors, for a complete list refer to NMFS SEFSC (2001).

3.12.4 Other factors influencing the Environmental Baseline

3.12.4.1 Marine Pollution

A number of activities that may indirectly affect listed species in the action area of this consultation include discharges from wastewater systems, dredging, ocean dumping and disposal, aquaculture, recreational fishing, and anthropogenic marine debris. The impacts from these activities are difficult to measure. Where possible, however, conservation actions are being implemented to monitor or study impacts from these sources. For example, extensive monitoring is being required for a major discharge in Massachusetts Bay (Massachusetts Water Resources Authority) in order to detect any changes in habitat parameters associated with this discharge. Close coordination is occurring through the section 7 process on both dredging and disposal sites to develop monitoring programs and ensure that vessel operators do not contribute to vessel-related impacts.

Sources of pollutants in Atlantic and Gulf coastal regions include atmospheric loading of pollutants such as PCBs, storm water runoff from coastal towns, cities and villages, runoff into rivers emptying into the bays, groundwater and other discharges, and river input and runoff. 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 effects on larger embayments is unknown. Although pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo *et al.* 1986), the impacts of many other anthropogenic toxins have not been investigated.

Coastal runoff and river discharges carry large volumes of petrochemical and other contaminants from agricultural activities, cities and industries into the Gulf of Mexico. The coastal waters of the Gulf of Mexico have more sites with high contaminant concentrations than other areas of the coastal United States, due to the large number of waste discharge point sources. Although these contaminant concentrations do not likely affect the more pelagic waters of the action area, the species of turtles analyzed in this Opinion travel between nearshore and offshore habitats and may be exposed to and accumulate these contaminants during their life cycles.

An extensive review of environmental contaminants in turtles has been conducted by Meyers-Schöne and Walton (1994); however, most information relates to freshwater species. High concentrations of chlorobiphenyls and organochlorine pesticides in the eggs of the freshwater snapping turtle, *Chelydra serpentina*, have been correlated with population effects such as decreased hatching success, increased hatchling deformities and disorientation (Bishop *et al.* 1991, 1994).

Very little is known about baseline levels and physiological effects of environmental contaminants on marine turtle populations (Witkowski and Frazier 1982, Bishop *et al.* 1991). There are a few isolated studies on organic contaminants and trace metal accumulation in green and leatherback sea turtles (Davenport and Wrench 1990, Aguirre *et al.* 1994). Mckenzie et al. (1999) measured concentrations of chlorobiphenyls and organochlorine pesticides in marine turtles tissues collected from the Mediterranean (Cyprus, Greece) and European Atlantic waters (Scotland) between 1994 and 1996. Omnivorous loggerhead turtles had the highest organochlorine contaminant concentrations in all the tissues sampled, including those from green and leatherback turtles. It is thought that dietary preferences were likely to be the main differentiating factor among species. Decreasing lipid contaminant burdens with turtle size were observed in green turtles, most likely attributable to a change in diet with age. Sakai *et al.* (1995) found the presence of metal residues occurring in loggerhead turtle organs and eggs. More recently, Storelli *et al.* (1998) analyzed tissues from 12 loggerhead sea turtles stranded along the Adriatic Sea (Italy) and found that characteristically, mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals and porpoises by Law *et al.* (1991). Research is needed on the short- and long-term health and fecundity effects of chlorobiphenyl, organochlorine, and heavy metal accumulation in sea turtles.

Generally, right whales and humpback whales do not use southeastern waters for feeding. Therefore, most of the effects from pollution would be expected in the northern summer feeding areas for these species. However, sea turtles nest primarily in the southeastern United States, and early life stages and breeding individuals of these species are likely to be impacted by pollution in these areas, as well as in the Northeast. Necropsies of hatchlings and juveniles show that young turtles commonly consume plastics and tar balls (STSSN stranding data base).

Oil spills from tankers transporting foreign oil, as well as the illegal discharge of oil and tar from vessels discharging bilge water will continue to affect water quality in the Gulf of Mexico. Cumulatively, these sources and natural oil seepage contribute most of the oil discharged into the Gulf of Mexico. Studies of floating tar sampled during the 1970s, when bilge discharge was still legal, concluded that up to 60% of the pelagic tars sampled did not originate from the northern Gulf of Mexico coast.

An additional source of mortality that has not been adequately assessed is the ingestion and long-term effects of *anthropogenic marine debris* by pelagic turtles. Preliminary indications are that approximately 15% of pelagic post-hatchling loggerheads from Florida beaches have ingested plastics and approximately 46% have ingested tar within the first few weeks of pelagic foraging (n=168) (Witherington, in review). Plastic and rubber latex debris is regularly found in the stomachs of necropsied stranded sea turtles. Of 1,710 turtles necropsied between 1980 and 1992, 11.5% had ingested debris, including plastic pieces and balloons: a greater proportion of loggerheads were affected than were Kemp's ridleys, and in both species the percentage impacted by digested debris was highest in the Gulf of Mexico (Witzell and Teas 1994).

Marine debris will likely persist in the action area despite of MARPOL prohibitions. In Texas and Florida, approximately half of the stranded turtles examined, in two studies limited to pelagic animals, have ingested marine debris (Plotkin and Amos 1990; Bolten and Bjorndal 1991). Of 43 dead stranded green turtles examined by Bjorndal *et al.* (1994), 24 had ingested some sort of debris. Although fewer individuals are affected, entanglement in marine debris may contribute more frequently to the death of sea turtles. A summary of marine debris impacts can be found in the TEWG reports (1998, 2000).

3.12.4.2 Natural biotoxins

Geraci *et al.* (1989) identified bioaccumulation of the neurotoxin responsible for paralytic shellfish poisoning (saxitoxin) in mackerel consumed by humpback whales as the possible cause of mortality of 14 humpbacks which stranded between November of 1987 and January of 1988. No saxitoxin was identified in plankton or shellfish sampled in Massachusetts waters at the time of the mortality. The authors suggest the neurotoxin could have been transported by mackerel obtaining the toxin from planktonic sources in the Gulf of St. Lawrence, the spawning ground for mackerel. While a similar multiple mortality of large whales has not been observed, the authors suggest individual mortalities caused by the biotoxin would go unnoticed. The reason for the multiple mortalities in the winter of 1987 and 1988 has not been explained, although they may have been related to a shift in the normal diet of humpbacks due to the lack of sand lance in the bays the previous summer.

3.12.4.3 Disease

An unknown *disease* is posing a new threat to loggerhead sea turtles. Between the period of September 2000 to January 2001, 45 debilitated and 95 dead loggerhead turtles have been found in south Florida between Indian River and Charlotte Counties, elevating stranding data for this period to more than 3 times the previous 10-year average (Foley, pers. comm., 2000). These numbers may represent only 10 to 20 % of the turtles that have been affected by this disease because many dead or dying turtles likely never wash ashore. If the agent responsible for debilitating these turtles remains in Florida, the scope of this die off may increase substantially. In addition, if the agent is infectious, nesting females could spread the disease throughout the range of the adult loggerhead population. Symptoms of the unknown disease include extreme lethargy and pneumonia. Of those found alive, even with extensive care, many of them have died and none have fully recovered. The cause of the disease has yet to be determined but potential causes include bacteria, virus, or exposure to some toxin.

3.12.4.4 Research and Enhancement

Both FWS and NMFS have issued several section 10(a)(1)(A) permits authorizing the take of listed whales and turtles in the action area for research and enhancement purposes (see Appendix II, NMFS SEFSC 2001). For turtles, these permits include activities such as capture, tagging, relocation, collection of blood samples, movement and treatment of injured turtles, behavioral studies, transport and possession of live turtles, and captive display. Although the conduct of these activities will disturb or harass several sea turtles, the effects of these activities on sea turtles are anticipated to be largely beneficial and no serious injury or mortalities are anticipated. Permits for research and enhancement of whales include activities such as photo-identification, tagging, biopsy, behavioral studies, and studies of blubber thickness. As with sea turtles, research and enhancement activities may disturb or harass whales, but no serious or long-term impacts are anticipated.

3.12.4.5 Nesting Beach Impacts

Beachfront development, lighting and beach erosion control all are ongoing activities along the Gulf and Atlantic coasts. These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, more and more coastal counties are adopting stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting.

3.12.5 Conservation and Recovery Activities

A number of activities are in progress that ameliorate some of the potential threat (impact) from the aforementioned activities. Education and outreach are considered one of the primary tools to reduce the threat of impact from private and commercial vessels. The USCG has provided education to mariners on whale protection measures and uses their programs such as radio broadcasts and notice to mariner publications to alert the public to potential whale concentration areas. The USCG is also participating in international activities (discussed below) to decrease the potential for commercial ships to strike a whale. In addition, outreach efforts for fishermen under the ALWTRP are increasing awareness and fostering a conservation ethic among fishermen that is expected, in the long term, to help reduce overall probability of adverse impacts in the environmental baseline from these commercial fishing activities.

Numerous recovery activities are being implemented to decrease the level of impacts from private and commercial vessels in the action area. These include the early warning system (EWS), other activities recommended by the Northeast Recovery Plan Implementation Team for the Right and Humpback Whale Recovery Plans and Southeast Recovery Plan Implementation Team for the Right Whale Recovery Plan, and NMFS regulations.

3.12.5.1 The Northeast and Southeast Early Warning Systems

Due to concern over potential collisions between right whales and hopper dredges operating in designated critical habitat for right whales in southeast waters, monitoring requirements were placed on the COE and resulted, in the 1980s, in the first regular aerial survey flights for right whales in waters off the Southeast United States. These surveys evolved over the years and, since late 1993/early 1994, have been officially sponsored by NMFS, the USCG, USN, and COE, and became known as early warning systems (EWS). The surveys were designed as daily reconnaissance flights to detect the presence of whales in and around a number of busy southeast shipping ports, USN vessel and submarine bases, and COE dredging sites, in order to alert vessels of the whales' presence and prevent potential whale/vessel collisions. The EWS, with the assistance of the USN and USCG, has evolved a sophisticated communication network which alerts not only dredges and military vessels in the area, but provides broadcasts to mariners via NAVTEX, NOAA Weather Radio, and other means, and even contacts vessels directly via radio when urgently necessary to prevent imminent collision.

Using the SEUS aircraft survey program as a model, efforts were initiated in 1996 to develop a similar program in the Cape Cod Bay and the Great South Channel in late winter and early spring. The program is a cooperative effort by NMFS, the USCG, Massachusetts Division of Fisheries, the Massachusetts Environmental Trust, the Center for Coastal Studies, the USN and MASSPORT (the Boston port authority). As a result of recommendations by the ALWTRT, a similar EWS, known as the "Sighting Advisory System," was established in the Northeast in late 1996. NMFS has the ability under the ESA to impose emergency regulations which may be used to protect unusual congregations of right whales. Through a fax-on-demand system, fishermen can obtain sighting reports and, in some cases, can make necessary adjustments in fishing practices to decrease the potential for entanglements. The Commonwealth of Massachusetts was a key collaborator in the 1996-1997 effort and expanded the effort during the 1997-1998 season. The USCG has played a key role in this effort, providing both air and sea support. The State of Maine and the Canada Department of Fisheries and Oceans have expressed interest in conducting this type of EWS along their coastal waters. It is expected that other potential sources of sightings such as the USN may contribute to this effort. The NMFS Maine ALWTRP Coordinator is also working with local aquaria to collect whale sightings from fishing vessels in the Gulf of Maine. All this cooperation will increase the chance of success of this program in diverting potential impacts in the environmental baseline.

3.12.5.2 The Northeast and Southeast Whale Recovery Implementation Teams

In order to address the known impacts to right and humpback whales described in the Recovery Plan, NMFS established the Northeast and Southeast Recovery Plan Implementation Teams (NEIT and SEIT). The Recovery Plans describe steps to reduce human impacts to levels that will allow the two species to recover and rank the various recovery actions in order of importance. The Implementation Teams provide advice to the various federal and state agencies or private entities on achieving these national goals within their respective regions. The teams both agreed to focus primarily on habitat and vessel related issues and rely on the take reduction plan process under the MMPA for reducing takes in commercial fisheries.

As part of NEIT activities, a Ship Strike Workshop was held in December 1996 to inform the shipping community of their need to participate in efforts to reduce the impacts of commercial vessel traffic on right whales. The workshop summarized current research efforts using new shipboard and moored technologies as deterrents, and a report was given on ship design studies currently being conducted by the New England Aquarium and Massachusetts Institute of Technology. This workshop increased awareness among the shipping community and has further contributed to reducing the threat of ship strikes of right whales. In addition, a Cape Cod Canal Tide Chart that included information on critical habitat areas and the need for close watch during peak right whale activity was distributed widely to professional mariners and ships passing through the canal. A radio warning was transmitted by Canal traffic managers to vessels transiting the Canal during peak Northern right whale activity periods. Follow-up meetings were held with New England Port Authority and pilots to notify commercial ship traffic to keep a close watch during peak right whale movement periods. At the request of the SEIT, the NEIT ship strike subcommittee expanded to include the Southeast. Additional ship strike meetings have been held with industry in the Southeast, mid-Atlantic, and Northeast and progress is being made to develop a vessel management strategy to greatly reduce potential whale/vessel interactions. In addition to its ship strike prevention activities, the SEIT established a GIS subcommittee and is progressing with work to analyze right whale sightings, vessel traffic information, and pertinent environmental data in order to better understand right whale distribution patterns in southeast waters and ultimately prevent human interactions with these whales.

3.12.5.3 The Whale Disentanglement Network

The Center for Coastal studies (CCS), under NMFS authorization, has responded to numerous calls to disentangle various whales entrapped in gear since 1984, and has developed considerable expertise in whale disentanglement. NMFS has supported this effort financially since 1995. The ALWTRP identifies whale disentanglement as an important component of the take reduction plan. As a result, NMFS greatly increased funding for this network, purchasing equipment caches to be located at strategic spots along the

Atlantic coastline, supporting training for fishermen and biologists, purchasing telemetry equipment, *etc.* This has resulted in a greatly expanded capacity for disentanglement along the entire Atlantic seaboard, including offshore areas. Memoranda of Understanding (MOUs) developed with the U.S. Coast Guard ensure their participation and assistance in the disentanglement effort. As a result, NMFS believes that many whales which may otherwise have succumbed to complications from entangling gear, are being set free to survive the ordeal.

3.12.5.4 Reducing Potential for Vessel Related Impacts

As part of recovery actions aimed at reducing vessel related impacts, NMFS published a proposed rule in August 1996 restricting vessel approach to right whales (61 FR 41116) to distances outside of 500 yards in order to minimize human-induced disturbance. The Recovery Plan for the Northern Right Whale identified disturbance as one of the principal human-related factors impeding right whale recovery (NMFS 1991b). Following public comment, NMFS published an interim final rule in February 1997 codifying the regulations. With certain exceptions, the rules prohibit both boats and aircraft from approaching any right whale closer than 500 yards. The regulations are consistent with the Commonwealth of Massachusetts' approach to regulations for right whales. These are expected to reduce the potential for vessel collisions inherent in the environmental baseline.

In April 1998, the USCG submitted, on behalf of the United States, a proposal to the International Maritime Organization (IMO) requesting approval of a mandatory ship reporting system in two areas off the east coast of the United States. The USCG worked closely with NMFS and other agencies on technical aspects of the proposal. The proposal was submitted to the IMO's Subcommittee on Safety and Navigation for consideration and submission to the Marine Safety Committee at IMO and approved in December 1998. The system will require all vessels over 300 tons to report to a shore-based station, thereby prompting a return message which provides precautionary measures to be taken to reduce the likelihood of a ship strike and locations of recent right whale sightings. The reporting system was initially implemented on July 1, 1999. The USCG and NOAA are playing important roles in helping to implement the system.

3.12.5.5 Measures to Reduce Impacts from Sound Sources

NMFS and the U.S. Navy have been working cooperatively to establish a policy for monitoring and managing *Acoustic Impacts from Anthropogenic Sound Sources* in the marine environment. Acoustic impacts can include temporary or permanent injury, habitat exclusion, habituation, and disruption of other normal behavior patterns. It is expected that the policy on managing anthropogenic sound in the oceans will provide guidance for programs such as the use of acoustic deterrent devices in reducing marine mammal-fishery interactions and review of federal activities and permits for research involving acoustic activities. The Office of Naval Research hosted a meeting in March 1997 to develop scientific and technical background for use in policy formulation. NMFS hosted a workshop in September 1998 to gather technical information which will support development of new acoustic criteria.

3.12.5.6 Measures to Reduce the Impacts of Aquaculture and Recreational Fishing

Aquaculture is currently not concentrated in whale high-use areas, but some projects have begun in Cape Cod Bay Critical Habitat and in other inshore areas off the Massachusetts and New Hampshire coast. Acknowledging that the potential for impacts is currently unknown, NMFS is coordinating research to measure habitat related changes in Cape Cod Bay and is ensuring through the section 7 process that these facilities do not contribute to the entanglement potential in the baseline. Many applicants have agreed to alter the design of their facilities to minimize or eliminate the use of lines to the surface that may entangle whales and/or sea turtles.

Recreational fishery interactions: Loggerheads, greens, and Kemp's ridleys are known to bite a baited hook, frequently ingesting the hook. Hooked turtles have been reported by the public fishing from boats, piers, and beach, banks, and jetties. Necropsies have revealed hooks internally which often were the cause of death. An investigation of injuries and mortalities related to fish hook ingestion is underway at the NMFS Laboratory, Galveston, Texas, and NMFS currently is exploring adding questions about encounters with sea turtles to intercept interviews of recreational fishermen conducted by the Texas Parks and Wildlife Department and under the auspices of the Marine Recreational Fishery Statistics Surveys conducted throughout the Gulf of Mexico and along the Atlantic Coast. NMFS is also considering questioning recreational fishermen aboard headboats throughout the southeast U.S. Atlantic and the Gulf of Mexico to quantify their encounters with sea turtles (TEWG 2000). A detailed summary of the impact of hook and line incidental captures on loggerhead sea turtles can be found in the TEWG reports (1998, 2000).

3.12.5.7 Measures to Reduce Incidental Takes of Sea Turtles in Commercial Fisheries

NMFS implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial fisheries. In particular, NMFS has required the use of TEDs in southeast U.S. shrimp trawls since 1989 and in summer flounder trawls in the mid-Atlantic area (south of Cape Charles, Virginia) since 1992. It has been estimated that TEDs exclude 97% of the turtles caught in such trawls. Regulations have been refined over the years to ensure that TED effectiveness is maximized through proper placement and installation, configuration (*e.g.,* width of bar spacing), floatation, and more widespread use. Analyses by Epperly and Teas (1999) indicate that the minimum requirements for the escape opening dimensions are too small, and that as much as 47% of the loggerheads stranding annually along the Atlantic seaboard and Gulf of Mexico were too large to fit through existing openings. On April 5, 2000, NMFS published an Advance Notice of Proposed Rulemaking to require larger escape openings (65 FR 17852). It is expected that the new TED requirements incorporating larger escape openings, when implemented, presumably no later than the fall of 2001, will have a significant effect on reducing shrimp trawl mortality of large, sexually mature loggerhead sea turtles and will contribute to the eventual recovery of the collective southeastern U.S. loggerhead population.

In 1993 (with a final rule implemented 1995), NMFS established a Leatherback Conservation Zone to restrict shrimp trawl activities off the coast of Cape Canaveral, Florida, to the North Carolina/Virginia border. This provides for short-term closures when high concentrations of normally pelagically distributed leatherbacks are recorded in more coastal waters where the shrimp fleet operates. This measure is necessary because, due to their size, adult leatherbacks are larger than the escape openings of most NMFS-approved TEDs. This rule was originally established because of coastal concentrations of leatherbacks which sometimes appear during their spring northward migration, but the rule was also recently implemented in the fall of 1999 off the coast of northern Florida due to unseasonable concentrations there. Leatherback TEDs were also required off the coast of Texas in the spring of 2000 due to unusual numbers of leatherback strandings.

NMFS is also working to develop a TED which can be effectively used in a type of trawl known as a flynet, which is sometimes used in the mid-Atlantic and northeast fisheries to target sciaenids and bluefish.

Limited observer data indicate that takes can be quite high in this fishery. A prototype design has been developed, but testing under commercial conditions has not yet been achieved.

The *Massachusetts Environmental Trust and Massachusetts Division of Marine Fisheries* have funded several projects to investigate fixed fishing gear and potential modifications to reduce the risk of entanglement to whales. These projects are an important complement to the NMFS research effort and have yielded valuable information on the entanglement problem. The Trust has also funded research on right whales in the Cape Cod Bay critical habitat area.

NMFS closed part of Pamlico Sound to the setting of gillnets targeting southern flounder in fall 1999 after the strandings of relatively large numbers of loggerhead and Kemp's ridley sea turtles on inshore beaches. This is a state-regulated fishery. NMFS also closed the waters north of Cape Hatteras to 38° N., including the mouth of the Chesapeake Bay, to large (> 6 inch stretched) mesh gillnets for 30 days in mid-May 2000 due to the large numbers of loggerhead strandings in North Carolina, and will continue to implement such proactive measures as necessary. A large proportion of these stranded loggerheads was assumed to be from the northern subpopulation. This assumption is partly supported by analyses conducted by Bass *et al.* (1999) on genetic samples collected from sea turtles stranding on U.S. Atlantic and Gulf of Mexico shores. The northern subpopulation accounted for 25-28% of the animals that stranded off the Carolinas, and 46% of the animals sampled that stranded in the northernmost area sampled, Virginia (TEWG 2000). Most recently, on October 27, 2000, the North Carolina Division of Marine Fisheries (NCDMF) closed waters in the southeastern portion of the Pamlico Sound as a result of elevated takes by the commercial large-mesh flounder gillnet fishery. The NCDMF and NMFS had agreed on details of a section 10 permit of the ESA for the founder fishery just prior to the closure. The fishery was closed when anticipated incidental take levels were met for green turtles. The NCDMF estimated that there were 50 loggerheads captured at the time of closure and that 44 of those had been drowned (NMFS SEFSC 2001, Part 1).

In addition, NMFS has been active in public outreach efforts to educate fishermen regarding sea turtle handling and resuscitation techniques. In addition to making this information widely available to all fishermen, in July and August 2001 NMFS conducted a series of workshops with longline fishermen to discuss bycatch issues, including protected species, and to educate them regarding handling and release guidelines. Meetings were conducted in Silver Spring, MD; Fairhaven, MA; Gloucester, MA, Islandia, NY; Barnegat Light, NJ; Manteo, NC; and Cape Canaveral, FL. NMFS intends to continue these outreach efforts and hopes to reach all fishermen participating in the pelagic longline fishery over the next 1 to 2 years.

3.12.5.8 Sea Turtle Stranding and Salvage Network Activities

There is an extensive network of sea turtle stranding and salvage network (STSSN) participants along the Atlantic and Gulf of Mexico that not only collects data on dead sea turtles, but also rescues and rehabilitates any live stranded turtles. In most states, the STSSN is coordinated by state wildlife agency staff, although some state stranding coordinators are associated with academic institutions. Data collected by the STSSN are used to monitor stranding levels and compare them with fishing activity in order to determine whether additional restrictions on fishing activities are needed. 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 are collecting tissue for and/or conducting genetic and ageing studies to better understand the population dynamics of the small subpopulation of northern nesting loggerheads. These states also tag turtles when live ones are encountered (either via the stranding network through incidental takes or in-water studies). Tagging studies help provide an understanding of sea turtle movements, longevity, reproductive patterns, *etc*.

Synthesis of the Environmental Baseline

To evaluate effects of the proposed action (see *Effects of the Action*, Section 4), the environmental baseline must involve more than a list of impacts. Some general conclusions need to be drawn about species trends and potential for progress towards recovery beyond the conditions that led to species listing under the ESA.
The combination of federal, state and private actions, plus international activities, as well as natural factors, may cause effects to protected species that could prevent or slow a species' recovery, depending on its current trends and whether the baseline is improving. Designation of critical habitat, proactive approaches by other federal agencies (*i.e.*, COE has limited dredging in southeastern channels to periods when turtles are not concentrated in the channels; USCG has implemented marine mammal procedures as normal operating instructions for vessel operators), participation by state, federal agencies, and the private sector in recovery plan implementation activities, the section 7 process, individual state action, are all contributing to mitigating potential cumulative effects on listed species.

Although most of the individual and synergistic effects of these existing factors in the environmental baseline on sea turtle and marine mammal populations cannot be quantified, the magnitude and duration of any these effects on individual species has varied greatly. Any combination of factors, discussed above, which have resulted in multiple mortalities have reduced each species' reproduction by reducing the number of adults that reproduce in a population, reducing the number of young an adult will produce in a time interval or a lifetime, increasing the time it takes for an adult to reproduce, increasing the number of years that pass before adult females return to breed, reducing the survival of young, or decreasing the number of young that recruit into the adult population. These effects are more obvious for species such as the right whale, whose population numbers are so small that very few mortalities can have significant impacts on survival and recovery. But effects are not as obvious for less known species such as fin whales, or for species that are not recovered to the criteria set forth in recovery plans but have an increasing population trend (*e.g.*, humpback whales for at least some populations).

The latest trend identified from the best scientific information available for right whales is that the population is in a decline. In addition, as noted earlier, the extremely small population size makes it very susceptible to the slightest perturbation in numbers. Fishery and ship-related mortality must continue to be reduced to meet survival and recovery goals. Humpback whales present a brighter picture. Current trend data suggest that the Gulf of Maine stock is steadily increasing, consistent with the trend in the North Atlantic population overall. Insufficient data are available to estimate population trends for fin whales and sperm whales. Until more information is available, threats to total recovery are still present from fishing and ship strikes and must continue to be minimized until recovery goals are met. While conservation activities also continue under the MMPA, many fisheries are still listed as having more than a negligible impact on these large whales stocks.

These individual and synergistic effects would be even greater in whales that bear only one young at a time and mature late. Their ability to replace themselves evolved in an environment with little natural adult mortality. Human impacts, as discussed herein, occur at a much higher rate than natural adult mortality. Coupled with the devastating reductions in initial population sizes by commercial whaling, these factors have made for a slow recovery.

Significant improvements in the environmental baseline are necessary for all of the species considered in this Opinion to ensure their survival and recovery in the wild. As discussed earlier, the potential for a turtle egg to develop into a hatchling, into a juvenile, and finally into a sexually mature adult will vary among species, and populations, and will be affected by the threats faced during each life stage. Females killed prior to their first successful nesting will have contributed nothing to the overall maintenance or improvement of the species' status. Anthropogenic mortality to females (or males) prior to the end of their reproductive life results in a serious loss of reproductive potential to the population.

Increased mortality of leatherback turtles at the egg and early life history stages due to habitat degradation on nesting beaches has likely impacted the leatherback's ability to maintain or increase its numbers by limiting the number of individuals that survive to sexual maturity. Likewise, mortalities of adult female loggerheads captured in commercial fishing gear have resulted in long-term reductions in the future reproductive output of loggerhead turtles. The age at sexual maturity of loggerheads may be as high as 35 years, while green turtles may not reach maturity until 30-60 years (*in* Crouse, 1999). Upon reaching maturity, female sea turtles generally lay between 100-130 eggs per clutch, minimally 2-3 clutches per year, every 2-4 years. Thus, in general, a female sea turtle will lay between 200-390 eggs per season every 2-4 years. Loss of individual subadult female turtles due to any one of the factors discussed above, therefore, will have long-term effects on that species reproduction. The loss of individual female turtles would magnify these effects.

To better characterize cumulative impacts, NMFS recently modeled population trends and impacts for mortalities of loggerhead and leatherback sea turtles in the action area (NMFS SEFSC 2001). The population trends were calculated using nesting females; and, therefore, estimates of individual contribution of various mortality factors do not directly enter the calculation. As discussed earlier, this analysis concluded that the best available scientific information indicates that the northern subpopulation has been stable at best, possibly declining (*i.e.*, 0 to -5% rate), based on nesting beach data for 1978-1990. Data from 1990 to the present indicate that nests have been increasing annually (2.8 to 2.9%). However, caution must be used when reviewing any one time segment, rather than a long time series as discussed and graphically illustrate in Section 3.6.1. This is why the recovery plans require a 25-year trend.

Therefore, based on ESA guidance and the NMFS SEFSC (2001) review, for the purpose of this consultation, the northern subpopulation would be assumed to be at best stable, possibly declining. The Florida numbers have been increasing steadily over the longer time period (1978-1990) and have leveled off to 3.9 to 4.2% since 1990. Some scientists are currently speculating that while dramatic declines have been seen in nesting Pacific leatherbacks, the populations in the western Atlantic are apparently stable or increasing. However, after reviewing the leatherback population trends in the Atlantic from best available information, NMFS SEFSC (2001) concluded that conflicting information regarding their status makes it difficult to conclude whether or not the population is in decline. Nesting at some beaches is up, down at others. Again, it is important to remember the importance of long-term consistent data to verifying trends as noted above.

While not considered in the latest stock assessment (NMFS SEFSC 2001) because this analysis was specifically conducted for species most prevalent in longline bycatch, information on green, hawksbill, and Kemp's ridley turtles was summarized earlier. Green turtles are showing increasing trends at most sites; most hawksbill populations are suspected or known to be in decline, while Kemp's ridley data are suggesting that the decline has stopped and there is cautious optimism that the population is increasing.

NMFS SEFSC (2001) summarized the best available scientific information on what is known about the effects of human activities on the loggerhead and leatherback populations (many would also affect green, Kemp's ridley, and hawksbill sea turtles in areas in which they co-occur with the activity), but even with the best available information, was unable to quantify all if it. Even for those activities where quantitative values were available, they are not directly comparable (some represent estimates, some are observed, observations are at different levels of effort, *etc*.). Therefore, it is not possible to simply sum these values to arrive at some total estimate of numbers of turtles, even a minimum one. Instead, NMFS SEFSC (2001) looked at the impact of various mortality levels on sea turtle life stages to evaluate the pelagic longline activity in terms of the life stage it impacts the most. For example, to address the combined mortalities of pelagic loggerheads only, NMFS SEFSC (2001) estimated that an increase in pelagic juvenile loggerhead survival of 10% within the north Atlantic basin annually would be necessary to move the population trajectories from stable to increasing or from declining to slightly increasing. This is discussed in more detail in Sec 8.1.2 and the technical document should be consulted in its entirety for the complete explanation. The models considered both the more conservative view that populations are stable/declining to the optimistic view that the northern subpopulation is increasing. However, even without such a quantifiable estimate of each individual mortality factor, it is obvious that thousands of sea turtles of all species are being taken annually from various activities, with varying levels of associated mortality. This means that many of the factors contributing to their original listing have not yet been alleviated, particularly fishing-related mortality, a priority recovery activity. Therefore, minimizing takes of sea turtles in all fishery-related activities, based on their contribution to the baseline, is still imperative, including federal and state fisheries. As noted in the recovery plan, efforts need to continue until 25 years of trend data show an increase.

Given the current status of threatened and endangered species in the action area, and the magnitude of known and suspected mortalities affecting these species, it is reasonable to assume that the combined effects of factors existing in the environmental baseline have hindered the recovery of all of the species considered in this Opinion.

4.0 Effects of the Proposed Action

Pursuant to Section 7(a)(2) of the ESA, federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. In the *Description of the Action* section of this Opinion, NMFS provides an overview of the fisheries, particularly the distribution and timing of fisheries that use gear that impacts threatened and endangered species. In the *Status of the Species* section of this Opinion, NMFS provides an overview of the threatened and endangered species that are likely to be adversely affected by fisheries authorized under the HMS FMP. In this section of the Opinion, NMFS assesses the probable direct and indirect effects of a proposal to continue authorizing the existing HMS fisheries on threatened and endangered species and designated critical habitat. The fisheries authorized under the HMS FMP are likely to adversely affect listed species through gear interactions, primarily entanglement and hooking, which may injure or kill individual animals.

In this section of biological opinions, NMFS assesses the probable direct and indirect effects of the fisheries authorized under the HMS FMP on threatened and endangered species and designated critical habitat. The purpose of this assessment is to determine if it is reasonable to expect that the fisheries can be expected to have direct or indirect effects on threatened and endangered species that appreciably reduce their likelihood of surviving and recovering in the wild or appreciably diminish the value of designated critical habitat for both the survival and recovery of threatened and endangered species in the wild. This section begins with a discussion of approaches to jeopardy assessments, the evidence available for our assessment, and the assumptions NMFS made to overcome limits in the information available for the consultation.

4.1. Approach to the Assessment

Regulations implementing section 7(a)(2) of the ESA require biological opinions to evaluate the direct and indirect effects of federal actions to determine if it would be reasonable to expect them to appreciably reduce listed species' likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (16 U.S.C. '1536; 50 CFR 402.02). Section 7 of the ESA and its implementing regulations also require biological opinions to determine if federal actions would appreciably diminish the value of critical habitat for the survival and recovery of listed species (16 U.S.C. '1536; 50 CFR 402.02).

NMFS generally approaches jeopardy analyses in three steps. The first step identifies the probable direct and indirect effects of an action on the physical, chemical, and biotic environment of the action area. The second step determines the reasonableness of expecting threatened or endangered species to experience reductions in reproduction, numbers, or distribution in response to these effects. The third step determines if any reductions in a species' reproduction, numbers, or distribution (identified in the second step of our analysis) can be expected to appreciably reduce a listed species' likelihood of surviving and recovering in the wild. Jeopardy analyses compare reductions in a species' likelihood of surviving and recovering in the wild associated with a *specific* action with the species' likelihood of surviving and recovering in the wild that was established in the *Status of the Species* section of an Opinion. Jeopardy analyses also consider the importance of the action area to a listed species and the effects of other human actions and natural phenomena (that were summarized in the *Environmental Baseline)* on a species' likelihood of surviving and recovering in the wild. As a result, jeopardy analyses in biological opinion distinguish between the effects of a specific action on a species' likelihood of surviving and recovering in the wild and a species' background likelihood of surviving and recovering given the full set of human actions and natural phenomena that threaten a species.

An extensive number of published studies relate the effects of human activities to a species' reproduction, numbers, and distribution and relate those changes to a species likelihood of surviving and recovering in the wild. Generally, human activities can reduce a species' reproduction by reducing the number of adults that reproduce in a population, reducing the number of young an adult will produce in a time interval or a lifetime, increasing the time it takes for an adult to reproduce, increasing the number of years that pass before an adult females returns to breed, reducing the survival of young, or decreasing the number of young that recruit into the adult population (Andrewartha and Birch 1954, Caughley and Gunn 2000, Ebert 1999). Human activities can reduce a species' numbers by killing individual members of the species (immediately or over time), reducing the numbers of individuals born into a population, reducing the number of individuals that immigrate into a population, or increasing the number of individuals that emigrate from a population (Burgman *et al*. 1993, Caughley and Gunn 2000). Human activities can reduce a species' distribution by reducing its population size or density in ways that cause the species to abandon parts of its range (Fowler and Baker 1991).

The third step in jeopardy analyses — relating reductions in a species' reproduction, numbers, or distribution (described in the first two steps) to reductions in the species' likelihood of surviving and recovering in the wild — is the most difficult step because (a) the relationship is not linear; (b) to persist over geologic time, most species have evolved to withstand some level of variation in their birth and death rates without a corresponding change in their likelihood of surviving and recovering in the wild; (c) our knowledge of the population dynamics of other species and their response to human perturbation is usually too limited to support anything more than rough estimates. Nevertheless, jeopardy analyses must distinguish between anthropogenic reductions in a species' reproduction, numbers, and distribution that can reasonably be expected to affect the species' likelihood of survival and recovery in the wild from other (natural) declines.

Analyses to determine if an action is likely to destroy or adversely modify critical habitat that has been designated for listed species follow a similar pattern. The first step identifies the probable direct and indirect effects of an action on the physical, chemical, and biotic environment of the action area. The final step of adverse modification analyses determines the reasonableness of expecting these effects to appreciably reduce the value of critical habitat for the species likelihood of surviving and recovering in the wild (when compared with the baseline).

PROVIDING SPECIES THE BENEFIT OF THE DOUBT

Statistics provides two points of reference for analyzing data, information, or other evidence to test hypotheses: (1) analyzing data to minimize the chance of concluding that there was an effect from an activity or treatment that is being analyzed when, in fact, there was no effect or (2) analyzing data to minimize the chance of concluding that there was no effect when, in fact, there was an effect. These two points of reference are called "errors": the difference between them is that the first minimizes what is called Type I error while the second minimizes what is called Type II error (see Cohen 1987). Unfortunately, for most analyses, minimizing one type of error increases the risk of committing the other type of error. The concept of error is important for jeopardy analyses because Type II error places listed species at greater risk of extinction.

Analyses contained in biological opinions can minimize the likelihood of concluding that an action reduced a listed species' likelihood of surviving or recovering in the wild (or no effect on the value of critical habitat that has been designated for a listed species) when, in fact, no reduction occurred (Type I error) or the analyses can minimize the likelihood of concluding that an action did not reduce a listed species likelihood of surviving and recovering in the wild when, in fact, a reduction occurred (Type II error). To comply with direction from the U.S. Congress to provide the "benefit of the doubt" to threatened and endangered species [House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)], jeopardy analyses are designed to avoid concluding that actions had no effect on listed species or critical habitat when, in fact, there was an effect (Type II error). This approach to error may decrease risks to listed species and designated critical habitat, but increases the risk of concluding that there was an effect when, in fact, no effect occurred.

4.2 Scope of the Analyses

This biological opinion treats sea turtle and whale populations in the Atlantic Ocean as distinct from the Pacific Ocean populations for the purposes of this consultation. This approach is supported by interagency policy on the recognition of distinct vertebrate populations (Federal Register 61: 4722-4725). To address specific criteria outlined in that policy, sea turtle populations in the Atlantic basin are geographically discrete from populations in the Pacific basin, with limited genetic exchange (see NMFS and USFWS 1998a). This approach is also consistent with traditional jeopardy analyses: the loss of sea turtle populations in the Atlantic basin would result in a significant gap in the distribution of each turtle species, which makes these populations biologically significant. Finally, the loss of these sea turtle populations in the Atlantic basin would dramatically reduce the distribution and abundance of these species and would, by itself, appreciably reduce the entire species' likelihood of surviving and recovering in the wild.

These analyses in this Opinion are based on an implicit understanding that the sea turtles and whales considered in this Opinion are threatened with global extinction by a wide array of human activities and natural phenomena; we have outlined many of those activities in the *Status of the Species* section of this Opinion. NMFS also recognizes that some of these other human activities and natural phenomena pose a much larger and more serious threat to the survival and recovery of sea turtles and whales (and other flora and fauna) than the HMS fisheries. Further, NMFS recognizes that sea turtles will not recover without addressing the full range of human activities and natural phenomena — for turtles, patterns of beach erosion, predation on turtle eggs, and turtle captures, injuries, and deaths in international fisheries and other State, federal, and private activities, for whales, other commercial fisheries and shipping — that could cause these animals to become extinct in the foreseeable future (USFWS and NMFS 1997).

Nevertheless, this Opinion focuses solely on whether the direct and indirect effects of the HMS fisheries managed under the HMS FMP can be expected to appreciably reduce the listed sea turtles' and whales likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution. NMFS will consider the effects of other actions on threatened and endangered turtles as a separate issue. As stated previously, jeopardy analyses in biological opinion distinguish between the effects of a specific action on a species' likelihood of surviving and recovering in the wild and a species' background likelihood of surviving and recovering given the full set of human actions and natural phenomena that threaten a species.

4.3. Information Available for the Assessment

Detailed background information on the status of these species and critical habitat has been published in a number of documents including recent status reviews of sea turtles (NMFS and USFWS 1995, USFWS 1997); recovery plans for the eastern Pacific green turtle (NMFS and USFWS 1998a), U.S. Pacific populations of hawksbill sea turtles (NMFS and USFWS 1998b), loggerhead sea turtle (NMFS and USFWS, 1991), leatherback sea turtle (NMFS and USFWS 1992), and U.S. Pacific populations of olive-ridley sea turtles (NMFS and USFWS 1998c); and reports on interactions between sea turtles and gear used in pelagic fisheries (Bolten *et al*. 1996). In addition, Crouse *et al*. (1987), Crowder *et al*. (1994), Heppell (1998), Heppell *et al*. (1996, 1999, and 2000) published results from population models, sensitivity analyses, and elasticity analyses for various species of marine turtles, although most models are based on data on loggerhead sea turtles in the Atlantic Ocean.

Recently, NMFS' Southeast Fisheries Science Center (SEFSC) issued a stock assessment of loggerhead and leatherback sea turtles that included population assessments for these turtles in the Atlantic (NMFS SEFSC 2001). These analyses included estimates of the nesting abundance and trends, estimation of vital rates, population modeling and projections of population status under various scenarios, evaluation of genetic relationships between populations, assessment of the impact of the pelagic longline fishery on leatherbacks and loggerheads and evaluation of available data on other anthropogenic effects on these populations. Additionally, the document reviews the scientific literature on previous evaluations of status, trends and biological parameters of Atlantic loggerheads and leatherbacks. The NMFS' SEFSC (2001) assessment was reviewed by three independent experts [Center for Independent Experts (CIE) 2001]. As a result, the SEFSC' stock assessment report, the reviews of it and the body of scientific literature upon which these documents were derived form the primary basis for the jeopardy determinations in this opinion.

In addition to these published sources of information, the results of several workshops provided additional information to support this consultation. From August 31- September 1, 1999, NMFS held a workshop in Miami to discuss ways of monitoring the number of turtles taken and killed in the pelagic longline fisheries in the two ocean basins and to discuss steps that could be taken to reduce the takes. The resulting report (Kleiber and Boggs 2000) lists recommendations for collecting these data. Other workshops and expert working group meetings have been held since that workshop. The Working Group on reducing turtle bycatch in the Hawaii longline fishery held its first meeting in Los Angeles in September 2000 and its second meeting in San Diego, California. A NMFS-pelagic longline fishery workshop to discuss methods of reducing bycatch of sea turtles was held in Silver Spring, Maryland in January 2001. These workshops were used to obtain information and data directly from fishermen in order to collect "first-hand" information useful in developing research plans for mitigation procedures.

Despite this published and unpublished information, there are many gaps in scientific knowledge of the biology and ecology of sea turtles, including aspects of th their life history, population dynamics, and their response to environmental and other variables. The National Research Council (1990) identified some of these limits and recommended research on a wide array of variables, including age at reproductive maturity, age-specific rates of survivorship and fecundity, distribution, and migration. Wetherall (1996, *in* Bolten *et al.* 1996) further described limitations in the current understanding of sea turtle ecology and concluded that population models have limited predictive capacity and would have to rely on untested critical assumptions. Bolten *et al*. (1996) concluded that it will take many years to develop quantitative models that can provide precise guidance for management decisions. Pritchard (1996) concluded that humans do not currently have enough life history data on sea turtles to construct models that can be used for predictive purposes. As a result of these limits, quantitative models of the effects of changes in abundance, reproductive success, and other vital rates on a sea turtle's likelihood of surviving and recovering in the wild must be interpreted with care. For example, because of sample sizes and the statistical design of previous studies, quantitative estimates of the effects of human activities on loggerhead turtles throughout the entire Atlantic Basin are more reliable than trying to estimate the effects of a single human activity.

Determining the scope and magnitude of impacts of any fishery on sea turtle populations is complicated by the fact that all sea turtles lead an oceanic existence during most of their life history. There are broad gaps in human knowledge of sea turtles in the marine environment due to the difficulties in studying them away from their nesting beaches. Recent technological developments in satellite telemetry and genetic analyses are rapidly expanding our knowledge on the movements and habits of sea turtles in the marine environment, but much remains unknown. In contrast, at certain nesting beaches, reasonably good ecological data exist for the breeding stages of sea turtles when adult females, eggs, and hatchlings are accessible. Leatherback and olive ridley turtles are the most pelagic turtle species, often inhabiting waters well offshore. Other turtle species, such as green and loggerhead turtles, primarily inhabit coastal waters as adults, but spend varying stages of their immature lives in the open ocean. Adults of these species regularly undertake breeding migrations over deep water.

TURTLE MORTALITY ESTIMATES

Earlier assessments of the effects of longline fisheries on sea turtles have demonstrated that turtles are captured, injured, and killed from interactions with fishing gear. However, NMFS has no precise estimates of the percentage of sea turtles that are injured, seriously injured, or die from these interactions. These estimates are central to this analysis, but the scientific community, fishing industry, and conservation community have not agreed on a common approach to these estimates.

In its June 30, 2000, Opinion on the Atlantic HMS Fisheries, NMFS used mortality estimates that were derived primarily from Aguilar et al. (1995). After the release of NMFS' June 2000 Opinion on the HMS fisheries, Musick (2001) analyzed data collected by NMFS observers and summarized by Hoey (2000), observer reports from 2000, and data from other longline fisheries around the world. Based on his analyses, he challenged NMFS' conclusions and concluded that "it appears that hooking mortality rates of loggerheads may be within the range of 3.3 to 8.6%, and hooking mortality of leatherbacks in this fishery may be nil."

In response to questions that had been raised about the mortality estimates NMFS used in its June 2000 Opinion (for example, questions raised by Musick and others), NMFS tasked its Southeast Fisheries Science Center to conduct a more detailed analysis of the information available on sea turtles injuries and mortalities resulting from interactions with longline gear (including all of the information contained in Musick 2001). This was analysis was peer reviewed and published as a SEFSC technical document. Concurrently, the NMFS Assistant Administrator requested that the Office of Protected Resources evaluate available information on sea turtle injury and provide advice on criteria. On January 4, 2001, NMFS' Office of Protected Resources issued a memorandum that revised the criteria for determining injury to sea turtles as a result of interactions with longline gear (NMFS 2001b). That memorandum concluded that, other than Dr.Musick's review, all studies of sea turtle mortalities in longline fisheries in the western Pacific Ocean, eastern Atlantic Ocean, and the Mediterranean Sea produced mortality estimates that ranged between 34 and 42%. The memorandum noted that all of the sea turtles that were represented in mortality studies had received treatments that would increase their probable survival (for example, hooks were often removed, turtles were disentangled, and animals were allowed to recuperate on deck); animals that did not receive those treatments would be expected to have higher mortality rates. As a result of these analyses, NMFS' Office of Protected Resources recommended classifying 50% of longline interactions with all species of sea turtles as lethal and classifying 50% as non-lethal (see NMFS' January 04, 2001, memorandum and Appendix 4 of NMFS SEFSC 2001 for a complete review and analysis of relevant research and recommendations).

Since this issue was crucial to evaluating the impacts of longline fishing sea turtles, and in order to further refine the broad categories summarized in the January 4, 2001 memorandum, the Assistant Administrator asked for further discussion. On February 16, 2001, the directors of NMFS' Offices of Science and Technology, Protected Resources, and Sustainable Fisheries reviewed the recommendations contained in the January 4, 2001, memorandum and the data supporting those recommendations. Based on that review, these senior science and policy experts concluded that these classifications could be further refined based on the best information available in the scientific and commercial literature and supported the following recommendations on sea turtle mortalities: (1) sea turtles that are entangled in gear, but not hooked, and that are released with no trailing line and visible injuries would not be expected to suffer any mortalities; (2) sea turtles that are externally hooked, including mouth hooks that do not penetrate mouth tissues, would be expected to have a 27% mortality rate; (3) sea turtles that were hooked in mouth tissues or that ingest hooks would have a 42% mortality rate. This Opinion adopts the mortality estimates from the February 16, 2001, memorandum.

4.4. Effects of the Proposed Fisheries

4.4.1. U.S. Pelagic Longline Fishery

As discussed in the *Description of the Proposed Action* section of this Opinion, the U.S. pelagic longline fishery for Atlantic highly migratory species primarily targets swordfish, yellowfin tuna, or bigeye tuna in various areas of the North Atlantic Ocean in different seasons. Other target species include dolphin (which are caught incidental to the HMS fisheries), albacore tuna, pelagic sharks including mako, thresher, and porbeagle sharks, as well as several species of large coastal sharks. Although this gear can be modified (*i.e.*, depth of set, hook type, *etc.*) to target either swordfish, tunas, or sharks, like other hook and line fisheries, it is a multi-species fishery.

The lines used to target swordfish are generally deployed at sunset and hauled in at sunrise to take advantage of swordfish nocturnal, near-surface feeding habits. The lines used to target tuna are generally set in the morning, deeper in the water column, and hauled in the evening. Except for vessels of the distant water fleet which undertake extended trips, fishing vessels preferentially target swordfish during periods when the moon is full to take advantage of increased densities of swordfish near the surface. Pelagic longline gear is composed of several parts, as shown in Figures 2 and 3 of this Opinion.

Swordfish sets and mixed target sets are buoyed to the surface with floats, have few hooks between floats, and are relatively shallow. Tuna sets use a different type of float placed much further apart when compared to lines targeting swordfish. Compared with swordfish sets, tuna sets have more hooks per foot between the floats and the hooks are set much deeper in the water column (> 109 meters). The hooks are also different for each type of fish targeted by longline gear. Swordfish sets generally use “J” hooks and tuna sets use “tuna” hooks, which are more curved than “J” hooks. In addition, tuna sets use only bait while swordfish fishing uses a combination of bait and lightsticks.

Longline fisheries generally affect sea turtles by entangling or hooking the turtles in fishing gear. Turtles that become entangled in longline gear may drown when they are forcibly submerged or they may be injured by the entangling lines. Turtles that are hooked by longline gear can be injured or killed, depending on whether they are hooked internally or externally and whether the hook sets deep in their tissue. In addition to these immediate effects, longline gear can have long-term effects on a turtle’s ability to swim, forage, migrate, and breed, although these long-term effects are difficult to monitor or measure. The following discussions summarize the direct and indirect effects of longline gear on sea turtles and will be followed by a discussion of the probable responses of turtle populations to those effects.

4.4.1.1. Estimated Number of Turtles Taken in the Fisheries

Sea turtle bycatch estimates from observations of bycatch in the pelagic longline component of the swordfish/tuna/shark fishery number in the thousands. Estimates of the number of turtles taken incidental to the fisheries in the April 23, 1999 Opinion on the HMS fisheries (Scott and Brown 1997) were revised and updated by estimates provided in Johnson *et al.* (1999) and Yeung (1999) for NMFS’ June 30, 2000, Opinion on the HMS Fisheries. The most recent estimates of number of turtles incidentally taken in the HMS fisheries were estimated using a delta lognormal method of preferred pooling order (quarter, year, area). Total estimated take reported for loggerheads, over the period 1992 - 1999, was 7,891, with a lower confidence interval of 3,835 and an upper confidence interval of 18,805 for the 8-year period(See NMFS SEFSC 2001; for full discussion of the method). Totals for the most recent year available (1999) yield an estimate of 991 loggerheads taken (95% CI = 510 - 2,089).

For leatherbacks, an estimated total of 6,363 turtles were taken incidental to the fisheries between 1992-1999, with lower and upper confidence limits of 2,491 and 17,614, respectively. For 1999, an estimated 1,012 leatherbacks were taken (95% confidence interval = 410 - 2,786). Of the 7,891 loggerhead and 6,363 leatherback turtles estimated from observer records to have been captured by the U.S. Atlantic and tuna longline fisheries from 1992-1999, 66 loggerhead and 88 leatherbacks were estimated to have been released dead (NMFS 2001; see Table 5 on the following page).

As discussed in the *Turtle Mortality Estimates* discussion in the introduction to this section of the Opinion, NMFS assumes that (1) sea turtles that are entangled in gear, but not hooked, and are released with no trailing line and visible injuries would not be expected to suffer any mortalities; (2) sea turtles that are externally hooked, including mouth hooks that do not penetrate mouth tissues, would be expected to have a 27% mortality rate; (3) sea turtles that are hooked in mouth tissues or that ingest hooks would have a 42% mortality rate.

4.4.1.2. Geographic Distribution of Interactions Between Longline Fisheries and Turtles

Most interactions between the U.S. longline fleet and loggerhead and leatherback turtles occur from the Mid-Atlantic Bight northward (Witzell 1999). Observer data, however, revealed greater loggerhead interactions in the Caribbean in 1992 and equally numerous leatherback interactions in the Caribbean and the Gulf of Mexico in some years (Yeung *et al.* 2000).

Pelagic longline gear most commonly catches loggerhead and leatherback turtles (See Table 5). Witzell (1999) summarized turtle catch from logbook data (1992 - 1995) for U.S. Atlantic sets targeting swordfish and tuna, or both. The Northeast Distant Area (NED) accounted for 70% of the loggerhead and 47% of the leatherback captures that were reported north of the Mid-Atlantic Bight. June through November were the peak months for reported captures. A review of observer reports for sets targeting all species between 1990 - 1996, yielded similar results (Hoey 1998). The NED accounted for 75% of the loggerhead and 40% of the leatherback captures for all sampling areas. The NED also was the only area where interactions of 4 or more turtles occurred on a single set (Hoey and Moore 1999). July through November were the predominant months for turtle captures (Hoey 1998).

Analyses of the latest bycatch data show that the Northeast Distant (NED) captures the greatest numbers of loggerhead and leatherback turtles, with the highest numbers of captures occurring in the 3^{rd} quarter of the year at the height of fishing effort. Given the relatively low levels of effort in the NED when compared with the NEC, longline fisheries in the NED capture high numbers of sea turtles. Analyses of the observed data suggest that the timing and spatial distribution of the fishery have a greater

Table 5. Annual summed observed and delta-lognormal estimates of total marine turtle bycatch and the subset that were dead when released in the U.S. pelagic longline fishery (CL= confidence limit; CV =coefficient of variation)

species	year	observed catch	estimated catch	upper 95% CL	lower 95% CL	CV	estimated dead	upper 95% CL	lower 95% CL	CV
loggerhead	92	6	293	1149	78	0.79	0			
loggerhead	93	23	417	1414	142	0.69	9	46	2	1
loggerhead	94	88	1344	2392	859	0.3	31	158	6	1
loggerhead	95	129	2439	4542	1405	0.33	0			
loggerhead	96	13	917	2713	322	0.6	2	10	0	0.98
loggerhead	97	17	384	1281	124	0.68	0			
loggerhead	98	15	1106	3225	395	0.59	1	5	0	0.98
loggerhead	99	64	991	2089	510	0.39	23	117	5	1
leatherback	92	28	914	2716	353	0.6	88	449	17	1
leatherback	93	66	1054	2603	463	0.49	0			
leatherback	94	42	837	2433	328	0.59	0			
leatherback	95	61	934	2093	520	0.43	0			
leatherback	96	10	904	2074	231	0.44	0			
leatherback	97	7	308	1498	66	0.96	0			
leatherback	98	4	400	1411	120	0.72	0			
leatherback	99	45	1012	2786	410	0.55	0			
green	92	10	87	266	29	0.62	30	154	6	1
green	93	2	31	158	6	1	0			
green	94	2	33	169	6	1	0			
green	95	1	40	205	8	1	0			
green	96	0	16	60	4	0.76	2	10	0	0.98
green	98	0	14	52	4	0.75	1	5	0	0.98
hawksbill	92	1	20	102	4	1	0			
hawksbill	97	1	16	82	3	1	0			
hawksbill	98	1	17	87	3	1	0			
Kemp's Ridley	92	0	1	5	0	0.98	0			
Kemp's Ridley	94	1	26	133	5	1	0			
Kemp's Ridley	97	1	22	112	4	1	0			
unidentified	92	1	26	133	5	1	0			
unidentified	93	2	31	158	6	1	0			
unidentified	94	2	34	173	7	1	0			
unidentified	95	4	171	587	50	0.7	0			

influence on bycatch than effort or gear (NMFS SEFSC 2001)

Analyses of recent NMFS unpublished observer data for 2000 reveals that 87 sea turtles (34 leatherbacks, 48 loggerheads, and 5 unidentified turtles) were observed taken by the pelagic longline fleet in 2000, resulting in zero observed mortalities, with approximately 4% observer coverage overall. Seventy percent (61) of the interactions occurred in the 3rd and 4th quarters. Twenty-eight of the interactions occurred in the NED (Northeast Distant), 14 occurred in the Gulf of Mexico, 10 occurred in the Northeast Coastal, 10 occurred in the Mid-Atlantic Bight, 8 each in South Atlantic Bight and Florida East Coast, and 5 occurred in the North Central Atlantic.

4.4.1.3. General effects of longline fishing on sea turtles

Longline gear has two general effects on sea turtles: sea turtles become entangled in longline gear or they can become hooked. The sections that follow discuss the characteristics of longline gear that affect sea turtles and the nature of those effects.

4.4.1.3.1. Effects of forced submergence

Sea turtles can be forcibly submerged by longline gear, through a hooking or entanglement event, and the turtle maybe unable to reach the surface to breathe. This can occur at any time during the set, including the setting and hauling of the gear, and generally occurs when the sea turtle encounters a line that is too short to reach the surface or is too heavy to be brought up to the surface by a swimming sea turtle. For example, a sea turtle that is hooked on a 3-meter branchline attached to a mainline set at depth by a 6-meter floatline will generally not be able to swim to the surface unless it has the strength to drag the mainline approximately 3 more meters (discussed further below).

Turtles hooked by longline gear will sometimes drag the clip, attached to the branchline, along the mainline. If this happens, the potential exists for a turtle to become entangled in an adjacent branchline which may have another species hooked such as a shark, swordfish, or tuna. According to observer reports, most of the sharks and some of the larger tuna such as bigeye are still alive when they are retrieved aboard the vessel, whereas most of the swordfish are dead. If a turtle were to drag the branchline up against a branchline with a live shark or bigeye tuna attached, the likelihood of the turtle becoming entangled in the branchline is greater. If the turtle becomes entangled in the gear, then the turtle may be prevented from reaching the surface. Also, if a turtle drags the dropperline next to a floatline, the turtle may wrap itself around the floatline and become entangled.

Sea turtles that are forcibly submerged by longline gear undergo respiratory and metabolic stress that can lead to severe disturbance of acid-base balance. Most voluntary dives by sea turtles appear to be aerobic, showing little if any increases in blood lactate and only minor changes in acid-base status (pH level of the blood). Sea turtles that are stressed as a result of being forcibly submerged through hooking or entanglement in a line rapidly consume oxygen stores. This triggers an activation of anaerobic glycolysis and subsequently disturbs the acid-base balance, sometimes to lethal levels. It is likely that the rapidity and extent of the physiological changes that occur during forced submergence are functions of the intensity of struggling as well as the length of submergence (Lutcavage and Lutz 1997). In a field study examining the effects of shrimp trawl tow times and sea turtle deaths, there was a strong positive correlation between the length of time of the tow and sea turtle deaths (Henwood and Stuntz 1987).

Sea turtles forcibly submerged for extended periods of time show marked, even severe, metabolic acidosis as a result of high blood lactate levels. With such increased lactate levels, lactate recovery times are long (even as much as 20 hours). This indicates that turtles are probably more susceptible to lethal metabolic acidosis if they experience multiple captures, because they would not have had time to process lactic acid loads (*in* Lutcavage and Lutz 1997). Presumably, however, a sea turtle recovering from a forced submergence would most likely remain resting on the surface (given that it had the energy stores to do so), which would reduce the likelihood of being recaptured by a submerged longline. Recapture would also depend on the condition of the turtle and the intensity of fishing pressure in the area. NMFS has no information on the likelihood of recapture of sea turtles by the U.S. Atlantic longline fishery, Hawaii-based longline fishery, or other fisheries. However, in the Atlantic Ocean, turtles have been reported as captured more than once by longline vessels (on subsequent days), as observers reported clean hooks already in the jaw of captured turtles. Such multiple captures were thought to be most likely on 3 or 4 trips that had the highest number of interactions (Hoey 1998). In areas of turtle concentrations *(e.g.,* Mediterranean Sea, Grand Banks) turtles have been reported to have been hooked from 2 to 8 times (Panou *et al*. 1991, Gramentz 1989, Argano *et al*. 992, Witzell 1999, Hoey and Moore 1999; *in* NMFS SEFSC 2001, Part 3, Chap.5). This not only compounds mortality estimates, it complicates efforts to estimate the number of turtles captured in the fishery. Current bycatch estimates do not take into consideration that an animal may be captured multiple times, which could lead to an unquantifiable, though probably small, amount of overestimation of sea turtle take.

Respiratory and metabolic stress due to forcible submergence is also correlated with additional factors such as size and activity of the sea turtle (including dive limits), water temperature, and biological and behavioral differences between species, and will therefore also affect the survivability on a longline. For example, larger sea turtles are capable of longer voluntary dives than small turtles, so juveniles may be more vulnerable to the stress of forced submergence than adults. During the warmer months, sea turtles' routine metabolic rates are higher, which may magnify the effects of stress associated with entanglement or hooking on the turtles. In addition, disease factors and hormonal status may also play a role in anoxic survival during forced submergence. Any disease that causes a reduction in the blood oxygen transport capacity could severely reduce a sea turtle's endurance on a longline, and since thyroid hormones appear to have a role in setting metabolic rate, they may also play a role in increasing or reducing the survival rate of an entangled sea turtle (*in* Lutz and Lutcavage 1997). Turtles necropsied following capture (and subsequent death) by longline vessels in the Pacific fishery were found to have pathologic lesions. Two of seven turtles examined (both leatherbacks) had lesions severe enough to cause probable organ dysfunction, although whether or not the lesions predisposed these turtles to being hooked could not be determined (Work 2000). As discussed further in the leatherback and loggerhead subsections below, some sea turtle species are better equipped to deal with forced submergence.

Although a low percentage (typically < 1%) of turtles that are captured by longliners actually are reported dead, sea turtles can drown from being forcibly submerged. Such drowning may be either "wet" or "dry." In the case of dry drowning, a reflex spasm seals the lungs from both air and water. With wet drowning, water enters the lungs, causing damage to the organs and/or causing asphyxiation, leading to death. Before death due to drowning occurs, sea turtles may become comatose or unconscious. Studies have shown that sea turtles that are allowed time to stabilize after being forcibly submerged have a higher survival rate. This of course depends on the physiological condition of the turtle (*e.g.,* overall health, age, size), time of last breath, time of submergence, and environmental conditions (*e.g.,* sea surface temperature, wave action, *etc.*) at the time of submergence (NRC 1990). Turtles which survive initial forced submergence and are released from longline gear may not recover and could die shortly thereafter.

Reports of sea turtles being drowned during interactions with longline gear are rare (Budi, Shawhan, pers. comm. 2000; Hoey 1998; Yeung 2000). Between 1992-1999, 4,032 longline sets were observed, of which 429 (~11%) caught turtles. Most of the turtles caught in longline gear were either loggerheads or leatherbacks. Table 6 shows numbers and species of marine turtles caught in longline sets observed between 1992-1999 (NMFS 2001). The number of dead turtles is a subset of the total number caught. If these data are corrected for percent observer coverage (see NMFS SEFSC 2001 for computations), an average of 986 loggerhead and 795 leatherback turtles were captured in the fishery each year from 1992 to 1999, of which 8 and 11, respectively, were dead.

Table 6. Total observed turtles caught and number recovered dead in the pelagic longline fishery for swordfish and tunas, 1992-1999

Species	Caught	Dead	Sets
Loggerhead turtle	355	4	198
Leatherback turtle	263	1	201
Green turtle	15	2	11
Hawksbill turtle	3	0	3
Kemp's ridley turtle	2	0	2
Unidentified	14	0	14

The green, hawksbill, and Kemp's ridley turtles reportedly captured in the longline fishery were probably misidentified (NMFS SEFSC 2001). They were probably loggerhead turtles, which are the most common hard-shelled turtles taken in the fishery (Hoey 1998; Witzell 1999: *in* NMFS 2001). Information from these data for 1999 indicates that, of 45 leatherback, 64 loggerhead, and 3 unidentified turtles observed taken by the U.S. swordfish fleet; 1 loggerhead turtle was dead when it was brought aboard (NMFS SEFSC 2001).

Aguilar (1995) reports only 4 turtles were dead (of a total of 1,098 loggerheads hooked) when hauled onboard during longline sets by Spanish fishermen in the Mediterranean during July-September 1990 and June-August 1991. Spanish longline hooks are typically fished at about 25 m depth, compared to U.S. Atlantic longline depths of approximately 75-100 m. The low mortality estimates of sea turtles that have been reported to have been killed (through drowning) during interactions with the U.S. and Spanish fleets does not consider post-interaction effects on individuals that are injured during those interactions or the effect of those injuries on their longevity or reproductive success.

4.4.1.3.2. Effects of entanglement

Sea turtles are particularly prone to entanglement as a result of their body configuration and behavior. Records of stranded or entangled sea turtles reveal that fishing debris can wrap around the neck or flipper, or body of a sea turtle and severely restrict swimming or feeding. Over time, if the sea turtle is entangled when young, the fishing line will become tighter and more constricting as the sea turtle grows, cutting off blood flow, causing deep gashes, some severe enough to remove an appendage. Sea turtles have also been found trailing gear that has been snagged on the bottom, or has the potential to snag, thus anchoring them in place (Balazs 1985; Hickerson, pers. comm. 2001).

Sea turtles have been found entangled in branchlines (gangions), mainlines and floatlines. Longline gear is fluid and can move according to oceanographic conditions determined by wind and waves, surface and subsurface currents, *etc.*; therefore, depending on both sea turtle behavior, environmental conditions, and location of the set, turtles can become entangled in longline gear. If sea turtles become entangled in monofilament line (mainline, gangion or float line) the gear can inflict serious wounds, including cuts, constriction, or bleeding anywhere on a turtle's body. In addition, entangling gear can interfere with a turtle's ability to swim or impair its feeding, breeding, or migration. Sea turtles that are entangled in the longline fishery are most often entangled around the neck and foreflippers, and, in the case of leatherback turtles, are often found snarled in mainlines, floatlines, and branchlines (*e.g.,* Hoey 2000).

4.4.1.3.3. Effects of hooking

In addition to being entangled in a longline, sea turtles are also injured and killed by being hooked. Hooking can occur as a result of a variety of scenarios, some of which will depend on foraging strategies and diving and swimming behavior of the various species of sea turtles. For example, olive ridley turtles have been found with bait in their stomachs after being hooked, suggesting that they were attracted to bait and attacked the hook.

Leatherback, loggerhead, and olive ridley turtles forage on tunicates, particularly pyrosomas — the so-called "fiery bodies," which radiate light at night. If lightsticks are used on longline gear set at night to attract species like swordfish, sea turtles could mistake the lightsticks for their preferred prey and get hooked externally or internally. Witzell (1999) suggested that leatherbacks are attracted to the lightsticks used by vessels targeting swordfish, perhaps mistaking the light sticks for bioluminescent gelatinous prey and then becoming entangled in the line. However, analyses using observer data indicated that sea turtle (both loggerhead and leatherback) interactions were not positively correlated with the use of lightsticks (Hoey 1998 ; Kleiber 2000).

Sea turtles are either hooked externally — generally in the flippers, head or beak — or internally, where the animal has attempted to forage on the bait, and the hook is ingested into the gastro-intestinal tract, often a major site of hooking (E. Jacobson *in* Balazs *et al*. 1995). Table 7 (below) summarizes recent data on the location and number of sea turtles that were hooked in the Atlantic pelagic longline fishery in 1999 and 2000. Table 7 was used to get an estimate of how many turtle would be expected to be lightly hooked, deeply hooked, or entangled which has implications for the level of injury and mortality of turtles interacting with the fishery, which ultimately is important for assessing the effects of the action. The number of turtles in each category was divided by the total number of turtles (n) for that species for the two years of data. For hooked turtles the "not hooked" column was simply subtracted from the total. In both years, the percentage of loggerhead turtles hooked in longline gear (61.2 and 58.1% of all turtles hooked in 1999 and 2000, respectively) was larger than the percentage of leatherback turtles (35.9 and 36.1% of all turtles hooked, respectively). In both years, of the two turtle species, a greater percentage of loggerhead turtles were hooked in their beak or mouth (72.7 and 82.1% of all turtles observed hooked in their beak or mouth in 1999 and 2000, respectively) or had ingested the hook (100 and 93.8%, respectively)[1]. The "hooked in beak or mouth" values were calculated without including the "head or

[1] The observer data presented in Table 7, the best available, does not distinguish between turtles hooked in the hard parts of their beaks and mouths from those that were hooked in soft tissue, which made it difficult to fully apply the post-hooking mortality estimates recommended in NMFS January 14, 2001, memorandum. Turtles hooked in beak and

beak" column in the last column of Table 7 (A separate code in observer data). If you add these values to the total, only the 2000 figure changes (83.9); if you add the "unknown other" to this as well, you get 78.9 and 81.2, respectively. The most accurate value adds the head and beak category because review of observer comments for those animals reveals that they are comparable to "beak and mouth" records. In contrast, a greater percentage of leatherback turtles were hooked in the flippers (84.2 and 81.3% of all turtles observed hooked in their flippers in 1999 and 2000, respectively). NMFS would expect this general pattern to continue in future interactions between the longline fishery and sea turtles.

Table 7: The location of hooks observed on leatherback and loggerhead turtles in the longline fishery (from Appendix 3, NMFS 2001)

1999					**Hook Location**					
Species	beak or mouth	flipper	head or neck (external)	throat or esophagus (ingested)	not hooked	unknown beak or mouth	carapace or plastron	unknown other	head or beak	**n**
Leatherback	1	16	1	0	8	9	0	10	0	45
Loggerhead	8	3	2	10	1	37	0	3	0	64
Unknown	2	0	0	0	0	0	0	1	0	3
Total	**11**	**19**	**3**	**10**	**9**	**46**	**0**	**14**	**0**	**112**
Percentages	**0.0982**	**0.1696**	**0.0268**	**0.0893**	**0.0804**	**0.4107**	**0.0000**	**0.1250**	**0.0000**	

2000					**Hook Location**					
Species	beak or mouth	flipper	head or neck (external)	throat or esophagus (ingested)	not hooked	unknown beak or mouth	carapace or plastron	unknown other	head or beak	**n**
Leatherback	4	13	3	0	1	0	5	6	0	32
Loggerhead	23	3	0	15	0	0	0	6	3	50
Unknown	1	0	0	1	0	1	0	2	0	5
Total	**28**	**16**	**3**	**16**	**1**	**1**	**5**	**14**	**3**	**87**
Percentages	**0.3218**	**0.1839**	**0.0345**	**0.1839**	**0.0115**	**0.0115**	**0.0575**	**0.1609**	**0.0345**	

The greatest concern is for turtles that have ingested hooks. Like most vertebrates, the digestive tract of the sea turtle begins in the mouth, through the esophagus, and then dilates into the stomach. The esophagus is lined by strong conical papillae, which are directed caudally towards the stomach (White 1994). The presence of these papillae, coupled with the fact that the esophagus snakes into an S-shaped bend distal to the esophagus, make it difficult to see hooks, especially if they have been deeply ingested. Because of a turtle's digestive structure, deeply-ingested hooks are also very difficult to remove from a turtle's mouth without seriously injuring the turtle. A turtle's esophagus is attached firmly to underlying tissue; therefore, if a turtle swallows a hook and tries to free itself or is hauled by a vessel, the hook can pierce the turtle's esophagus or stomach and can pull organs from their connective tissue. These injuries can cause the turtle to bleed internally or can result in infections, both of which can kill the turtle.

mouth were assumed to fall into the 27% mortality category.

If a hook does not lodge into or pierce a turtle's digestive organs, it can pass through to the turtle's colon or it can pass through the turtle entirely (E. Jacobson *in* Balazs *et al*. 1995; Aguilar *et al.* 1995). In such cases, sea turtles are able to pass hooks through the digestive tract with little damage (Work 2000). Of 38 loggerheads deeply hooked by the Spanish Mediterranean longline fleet and subsequently held in captivity, six loggerheads expelled hooks after 53 to 285 days (average 118 days) (Aguilar *et al*. 1995). If a hook passes through a turtle's digestive tract without getting lodged, the hook probably has not harmed the turtle. Tissue necrosis that may have developed around the hook may also get passed along through the turtle as a foreign body (E. Jacobson *in* Balazs *et al*. 1995).

As discussed in the introduction to this section of this Opinion, NMFS has reviewed the scientific and commercial information available on sea turtle mortalities associated with interactions with longline gear in the western Pacific Ocean, eastern Atlantic Ocean, and the Mediterranean Sea. Assuming the mortality rates in the memorandum, 27% of the loggerhead turtles hooked in their beak or mouth and 27% of the leatherback turtles that were hooked in their flippers coded in table 7 would be expected to die. Based on that policy, 42% of the loggerhead turtles that ingested hooks would be expected to die. Again, NMFS would expect this pattern to continue in future interactions between the longline fishery and sea turtles -- the percentage of type of interaction identified in table 7 and the mortality rates identified in the February 2001 memorandum will be used to analyze the effects of this action on loggerhead sea turtles in Section 6.1 and leatherback sea turtles in section 6.2.

4.4.1.4. Factors contributing to the likelihood of an interaction with the longline fishery

The following subsections describe aspects of longline fishing, including gear characteristics as well as environmental conditions, that may contribute to the likelihood of sea turtle interactions with this fishery.

4.4.1.4.1. Gear

Floats: Sea turtles may be attracted to the floats used on longline gear. Sea turtles have been observed associating with manmade structures significantly more frequently than with natural objects, perhaps related to turtles' affinity for 3-dimensional objects. Turtles also show a preference for objects floating horizontally and nearly submerged and are strongly attracted to brightly colored objects (Arenas and Hall 1992). Floats typically used during swordfish-style sets are bright orange, bullet-shaped, and slightly submerged. Tuna-style sets generally use larger cylindrical inflatable buoys and floats, and these also are typically orange in color (L. Enriquez, pers. comm., January 2001). An analysis of observer data from the Hawaii-based pelagic longline fleet found that the proximity of the gangion to a floatline had a strong, significant effect on turtle catch rates. For hauls that captured loggerhead turtles, 45% of the loggerhead turtles that were caught were on the hooks nearest a floatline, even though those hooks only represented 20% of the hooks set. The remaining 80% of the gangions set farther from the floatlines accounted for 55% of the loggerhead captures. The results are similar for leatherbacks: 49% of leatherbacks that were caught were on the hooks nearest the floatline, which composed only 17% of the hooks set (NMFS SWFSC, unpubl. data). This effect may be explained by turtles being attracted to the buoys and the marine life that assembles under them. The hooks closest to the floatlines would also be shallower than the hooks farther away, so it is also possible that these results reflect a depth effect, or an interaction of shallow depth and proximity to a surface attractor.

Bait: Sea turtles may also be attracted to the bait used on a longline. Four olive ridleys necropsied after being taken dead by Hawaii-based longliners were found with bait in their stomachs (Work 2000).

Loggerheads are routinely taken by U.S. and Spanish longline fishermen using various baits. In addition, a leatherback was documented ingesting squid bait on swordfish longline gear.

Lightsticks: Lightsticks are often used by longliners targeting swordfish in order to attract the swordfish to the bait. Skillman and Balazs (1992) speculate that the lightsticks may initially attract leatherbacks as was seen in the Spanish longline fleet example (above) by simulating natural prey. Preliminary findings by Lohmann (2000) indicate that glowing lightsticks are attractive to young, pelagic stage loggerhead turtles, whereas unbaited hooks are not. Whether lightsticks attract swordfish directly or whether they attract baitfish, which in turn attract the swordfish, is not entirely clear; however, fishermen report higher takes of swordfish when they use lightsticks. Lightsticks are generally attached to every other branchline, approximately a meter above the hook. Sea turtles foraging at night may be attracted to the lightsticks, confusing them for prey. Researchers studying the prey and foraging habits of sea turtles have reported the ingestion of pyrosomas, the so-called "fiery bodies," by leatherbacks, loggerheads, and olive ridleys; however, there is little information on the actual ingestion of lightsticks by sea turtles. Several authors have suggested that the use of lightsticks contributes to the incidental take of sea turtles in pelagic longline fisheries (Witzell and Cramer 1995; Price 1995). Examination of logbook data indicated that catch per unit effort for leatherbacks and loggerheads doubled with the use of lightsticks (Witzell and Cramer, 1995). However, Hoey's 1998 analysis of Atlantic pelagic longline observer data from 1990 - 1996 indicated that lightstick use had little bearing on levels of sea turtle bycatch. Statisticians have not been able to find any correlation between sea turtle take and the proximity of a lightstick to the hook or branchline that the turtle was hooked on or entangled in. For the Hawaii longline fishery, Skillman and Kleiber (1998) and Kleiber (2000, draft) were unable to predict turtle capture based on lightstick use. The use of lightsticks was associated with a number of other more significant predictor variables, *e.g.*, latitude and fishing for swordfish (Skillman and Kleiber 1998). Preliminary results of a study on the response of post-hatchling loggerheads to light sticks indicate that the turtles were strongly attracted to glowing green lightsticks and were weakly attracted to glowing yellow Coghlan lightsticks (Lohmann 2000). Methodology developed for testing these animals needs to be applied to older animals.

4.4.1.4.2. Effects of hook styles on hook ingestion

A variety of fishhook styles are used in the pelagic longline fisheries (D. Lee, pers. comm. 2000 *in* NMFS SEFSC 2001). Boats may fish several styles of hooks at any one time depending on target species and hook availability. The swordfish fishery uses traditional "J" style hooks while the tuna fishery uses circle hooks. From July to December, 2000, researchers experimented with different styles of hooks in the commercial, Azores longline fishery in the Azores Islands to determine their effect on sea turtles incidentally captured in the fishery.

The experiment consisted of 93 longline sets, each set consisting of 1,500 hooks baited with squid. The target species were swordfish and blue sharks. Three hook types were tested: straight "J"(Mustad #76800 D 9/0), reversed/offset "J" (30/0-32/0) (Mustad #76801 D 9/0), and circle (Mustad #39960 ST 16/0). The hooks were alternated along the set and because there were 8 hooks between buoys, the relationship between hook type and hook position on the gear varied. The order of gear set was: large buoy with radar reflector, 4 small buoys, large buoy, four small buoys, large buoy with reflector, *etc.*(A. Bolten, pers. comm.). The branchline (gangion) length, including leader, was 14 m and they were spaced 45 m apart along the mainline. Buoy lines were 5.4-14.4 m long: line length on the large buoy with radar reflector was 14.4 m, large buoy line length was 10.8 m, and the line length on the small buoys was 5.4 or 10.8 m, depending on fishing conditions, and was determined by the captain. A single 25.4-m vessel was used throughout the experiment.

The experimental fishery caught 232 loggerhead, 4 leatherback, and 1 green turtle. The CPUE for all species combined was estimated at 1.7 turtles/1,000 hooks. There was no significant difference in the total numbers of turtles caught by each hook type (Chi-square test, p=0.136). However, there was a significant difference among the 3 hook types in the percentage of turtles hooked in their throats (Chi-square test, p<0.001):

Percent Hooked in the Throat:		
	Standard "J" Hook	57%
	Offset "J" Hook	46%
	Circle Hook	11%

During the experiment, more turtles tended to be caught on hooks closest to buoys, but there was no significant effect of hook position along the mainline on turtle bycatch (Chi-square test, p = 0.515).

Based on this experiment, there is a clear relationship between the type of hook and sea turtle injuries. The experiment also suggests that the location of hooking can be changed by changing the type of hook. The relationship between circle hooks and lower levels of seriously injured sea turtles was an encouraging result of the experiment. Assuming that turtles that swallow hooks are less likely to survive an interaction than turtles that are hooked in their mouths, circle hooks would reduce the number of turtles ingesting hooks (although they would not reduce the number of turtles hooked) and would reduce the number of turtles that die from injuries caused by ingesting hooks. Additionally, the position of the hook in the mouth differed with hook type. The "J" style hook, when embedded in the mouth, was more likely to be in the upper jaw, possibly damaging the soft palate just beneath the brain case. The circle hook, on the other hand, was more likely to be embedded in the hard, lower jaw, where injury likely would be less. Thus, positioning of the hook in the turtle's mouth has survival implications (A. Bolten, pers. comm.).

Although the results of these initial experiments with circle hooks were promising, their use is being debated for a variety of reasons. Changing from "J" to circle hooks may adversely affect the catching success for target species, particularly for the swordfish fleet. In the Azores experiment, there was a significant difference among the hook types in the numbers of swordfish caught (Chi-square test, p < 0.001). The circle hook caught 262 swordfish and the "J" hook caught 381 swordfish (a 31.1% reduction). In addition, several fishermen have commented that it is much more difficult to remove a circle hook from a turtle's mouth than the commonly used "J" hook, because circle hooks are easier to swallow, and fishermen could unintentionally aggravate hooking injuries while attempting to remove circle hooks (Beideman, Budi, pers. comms. 2001). Furthermore, preliminary results with deeply hooked and lightly hooked (on "J" hooks) satellite tagged sea turtles in Hawaii and the Azores seem to indicate no significant difference in post-release tracks of the differently hooked turtles.

4.4.1.4.3. Effects of trailing gear

Trailing line (*i.e.*, line that is left on a turtle after it has been captured and released), particularly line trailing from an ingested hook, poses a serious risk to sea turtles. Line trailing from an ingested hook is likely to be swallowed, which may occlude the gastrointestinal tract, preventing or hampering foraging, leading to eventual death. Sea turtles that swallow the monofilament that is still attached to an embedded hook may suffer from the "accordion effect" described by Mediterranean sea turtle researchers, usually fatal, whereby the intestine, perhaps by its peristaltic action in attempting to pass the unmoving monofilament line through the alimentary canal, coils and wraps upon itself (Pont, pers. comm. 2001). Trailing line may also become snagged on a floating or fixed object, further entangling a turtle and potentially slicing its appendages which may affect its ability to swim, feed, avoid predators, or reproduce.

Observers on longline vessels that have captured (hooked) a turtle are directed to clip the line as close to the hook as possible in order to minimize the amount of trailing gear. This is difficult with larger turtles, such as the leatherback, which often cannot practicably be brought on board the vessel. This is also difficult in inclement weather, when such action might place the observer or the vessel and its crew at risk. Because less than 5% of trips carry observers in the U.S. Atlantic-based pelagic longline fishery, there may be many sea turtles released with trailing gear; although, U.S. fishermen indicated that they make every effort to safely remove as much trailing gear as possible (Beideman, Budi; pers. comms. 2001).

Analyses of fishery observer logs for the 4th quarter of 2000 for the U.S. Atlantic pelagic longline fishery shows that of 21 turtles hooked, hooks were removed from 5 turtles (24%), line was clipped from the hooks of 4 turtles (19%), and the remaining 12 turtles (57%) were released with varying lengths of 400-lb test monofilament, ranging from 1 to 6 feet, still trailing from the hook (mean = 3.25 ft) (NMFS SERO unpubl. data).

4.4.1.4.4. Environmental conditions

Environmental conditions may also play a large part in whether or not a sea turtle interacts with longline gear. Sea turtles in the open ocean are often found associated with oceanographic features such as fronts and driftlines, areas often indicating high productivity. In addition, sea turtles also appear to associate with particular sea surface temperatures. As mentioned in more detail later, species such as loggerheads have been tracked moving along convergent ocean fronts, in waters with sea surface temperatures of 17° C and 20° C (Polovina *et al*. 2000). Swordfish are caught by longliners in association with frontal zones where ocean currents or water masses meet to create turbulence and sharp gradients of temperature and salinity. Swordfish also make vertical migrations through the water column, rising near the surface at night from deep waters. Thus, while searching for concentrations of swordfish, longline vessels set their gear across these temperature gradients ("breaks") indicative of intersecting water masses, and when sea turtles are associated with these fronts, interactions are more likely.

4.4.2. Bottom Longline Fishery for Sharks in Southeastern U.S.

Bycatch data for the bottom longline fishery predominantly targeting sharks in the southeastern U.S. were previously unavailable. However, an observer program conducted by the Gulf and South Atlantic Fisheries Development Foundation recorded incidental takes of sea turtles in this fishery (Branstetter and Burgess1997). Between 1994 and 1996, a total of 408 sets were observed, comprising 4.1 million hook hours. The total effort in this fishery is unknown; however, the sharks landed via observed vessels represented between 2% and 5% of all sharks landed. According to Branstetter (NMFS, St. Petersburg, FL, pers. comm.), about 50 vessels land the majority of the quota and the fishery generally operates in 10 - 20 fathoms. About 50 – 55% of the total landings are recorded in Florida, followed by North Carolina and Louisiana at 20% each, Texas at about 1 - 2%, and most of the remainder is from the mid-Atlantic. In the 408 sets observed, 25 loggerheads were taken and released live and another 6 were recorded dead (implying a mortaltiy rate of 19%). Eleven of these turtles were taken between South Carolina and Northeast Florida (South Atlantic Bight), 16 in the Florida Gulf and 4 in North Carolina. Additionally, 2 leatherbacks were entangled and released alive, 1 in the South Atlantic Bight area and 1 off North Carolina. Preliminary data from this observer program in 1998 indicate that out of 106 sets observed, 2 loggerheads and 1 unidentified turtle were taken and released alive in that year (Branstetter, NMFS, St. Petersburg, FL, pers. comm.).

Between August 1995 and December 2000, scientists from the NMFS Laboratory in Pascagoula, Mississippi, aboard NOAA fishery research vessels operating in the Gulf of Mexico, Atlantic, and Caribbean, conducted 1,424 bottom longline sets for sharks, setting approximately 1,424 miles of longline gear and 14,240 hooks. One loggerhead was captured and had drowned.

Observed sets in this fishery are presumed to represent between 2 and 5% of total shark landings. Correcting for observer coverage suggests that between 620 - 1,550 loggerheads could be taken in this fishery over 3 years, or 207 - 517 annually (19% of which would be 40 - 99 turtles). This approach may over-estimate the interaction, because these estimates are based on total shark landings, which make it difficult to reach definitive conclusions.

According to the HMS FMP, the rebuilding plan for the shark fishery which reduces quotas and limits access, among other measures, can be expected to reduce the level of effort in this fishery. If the rebuilding plan reduces the effort, the numbers of turtles captured and killed in this fishery should decrease as well.

4.4.3. Pelagic Drift Gillnet Fishery

The pelagic drift gillnet portion of the Atlantic swordfish fishery was prohibited during an emergency closure that began in December 1996, extended through May 31, 1997, and subsequently extended through July 31, 1998. An extensive environmental assessment was prepared to evaluate this fishery from both fisheries and protected species perspectives, to identify measures to be implemented for the longline and drift gillnet fisheries. The Northeast swordfish drift gillnet segment was reopened on August 1, 1998, and a total of 10 trips were reported. An additional two drift gillnet trips targeting tuna took place in September using a net with smaller mesh.

The final rule to close the entire swordfish drift gillnet fishery was published on January 27, 1999 (64 FR 4055), and a Notice of Availability for the draft comprehensive FMP for the whole pelagic fishery was published on October 26, 1998 (63 FR 57093). Under the HMS FMP, this gear-type was prohibited for the harvest of tuna to prevent expanding the use of this gear in other fisheries. The number of turtles and marine mammals captured in this fishery was high and included a number of large whales. Prohibiting this gear has significantly reduced the potential for jeopardy to right whales, and eliminated one source of injury and mortality of humpback whales, sperm whales and sea turtles.

4.4.4. Southeast Shark Drift Gillnet Fishery

For the Southeast shark drift gillnet fishery, unpublished data from the Florida Fish and Wildlife Conservation Commission for shark gillnet landings from the coast of Florida from Nassau County to Broward County indicate that in 1998, of vessels targeting sharks (defined as those reporting landings of >500 lbs), a total of 706,510 lbs of shark were landed in 278 trips along the Florida east coast. In 1999, a total of 706,510 lbs of shark were landed in 265 trips.

In southeast waters where right whales may occur, the ALWTRP prohibits most drift gillnet activity for sharks. Provided that a vessel carries an observer, gillnetting is allowed in a small area off the east coast of Florida (from the City of Sebastian south) where right whales are not likely to occur in federal waters because of the proximity of the warm waters of the Gulf Stream. An exemption is also granted for strike netting for sharks under these rules, provided the captain/vessel uses a spotter pilot, fishes only during the daytime, does not set gear within 3 nm of a right whale sighting, and carries an observer. Seventeen strike net trips have been observed to date (1999-2001), with no reports of interactions with threatened or endangered species.

Prior to implementing the ALWTRP, 121,559 lbs of shark were landed in 194 gillnet trips which took place between November 15, 1996, and March 31, 1997. Ninety percent of these landings were caught by 13 fishermen landing 500 lbs or more of shark/trip, in 48 trips, indicating that these data represent shark as the target species (rather than bycatch landings). Implementation of the ALWTRP in July, 1997, subsequently closed the area from Savannah, Georgia, to Sebastian, Florida, to shark gillnetting from November 15, 1997, to March 31, 1998.

Landings data for this period indicate that six gillnet fishermen landed shark, but only one of these fishermen arranged for an observer despite a 100% observer coverage requirement. Data through January 1999 from Florida indicate that 88 gillnet trips landed sharks and that 13 different fishermen landed sharks during the 1998 portion of the right whale calving season when restrictions on shark gillnet fishing are in place (November 15 - December 31). None of these fishermen called to arrange for an observer during that time period, although 4 of them called and took observers beginning January 1999. Florida data indicate only one fisherman may have actually targeted sharks between November 15, 1998, and January 31, 1999, suggesting that efforts to educate fishermen about the call-in requirement may have been effective. The 1999-2000 season went smoothly, with fishermen regularly reporting their intentions to fish, even after observers were no longer available.

Nine sets were observed outside of the right whale season in 1998, but no sea turtle takes were observed. Fifty-three sets were observed in 1999; 70 sets in 2000. Since 1993, 5 loggerhead turtles have been captured in the fishery (1 was killed), 14 leatherback turtles have been captured (2 were killed and the condition of 2 others is unknown), and 1 hawksbill turtles was captured and released; the animal was comatose and is considered dead (Carlson 2001, unpub. data). All reports of leatherback turtles being captured in the fishery since 1993 (14 were captured, 2 were killed) occurred since January 18, 2001. At the same time that leatherback were reported as having been captured in the shark gillnet fishery, 3 leatherback stranded in the area of the shark drift gillnet fishery. One of these stranded animals was an adult male with abrasions around his shoulders, which are consistent with entanglement in gillnet gear. A necropsy concluded that the abrasions occurred prior to his death.

It is difficult to determine the frequency of interactions between the gillnet fishery and leatherback turtles. Leatherbacks begin nesting as early as February along the Florida east coast. In 2001, the first nest was documented on March 3 at Melbourne Beach. Considering the rarity of leatherbacks on fishing grounds for this fishery – an average of only 45-50 females nest in Florida each year – the documented take in the shark drift gillnet fishery, especially during a time when reproductive females are present, could have serious effects of this breeding population's likelihood of surviving and recovering.

Nevertheless, this fishery does not seem likely to interact with leatherback turtles every year, or the interaction will probably reflect surface temperature patterns and prey conditions or a change in fishing practices that could increase the number of interactions. Pelagic coelenterates (Scyphozoa and Siphonophora) are a major component in the diet of leatherback turtles (Den Hartog 1980, Den Hartog and Van Nierop 1984) and the occurrence of turtles often corresponds to concentrations of jellyfish (Leary 1957, Fritts *et al.* 1983, Collard 1990, Grant *et al.* 1996, James 2000: *in* NMFS SEFSC 2001).

Therefore, high abundances of the jellyfish (*Aurelia*) in the fishing area may attracted the turtles and increase the likelihood of interactions between the turtles and the fishery.

The HMS FMP prohibits shark drift gillnet fishing without an observer onboard; which is believed to strengthen the provisions of the ALWTRP. Since issuance of the June 30, 2000, Opinion, 100% observer coverage of the shark gillnet fishery has been maintained during right whale calving season, as required in lieu of a vessel monitoring system (VMS).

NMFS believes that measures discussed above will reduce the chances of a right whale becoming entangled in gear associated with the HMS fisheries; if a whale is entangled, the presence of observers increases the likelihood that the disentanglement network would be notified in time to release and disentangle the whale before it is seriously injured. NMFS believes that a monitoring system such as VMS could also ensure compliance with the closure, leaving only a remote possibility of even encountering a right whale, much less entangling one, outside the closed area. A review of the observer data for the 1999/2000 right whale calving season indicates that all observed vessels complied with the closure. Implementing a shark drift gillnet VMS would eliminate the requirement for 100% coverage in this fishery.

4.4.5. Bluefin Tuna Purse Seine Fishery

The bluefin tuna purse seine fishery is currently listed as a category III fishery under the MMPA. Purse seines are set when a school of fish is located, then the vessel pays out the net in a circle around the school. This affords considerable control over what is encircled by the net and the net does not remain set in the water for an appreciable amount of time. This fishery was observed in 1996, with close to 100% coverage. Six pilot whales, one humpback whale and one minke whale were observed as encircled by the nets during the fishery. All were released alive or dove under the net and escaped before it was pursed. Additionally, unpublished data from NMFS Northeast Region's entanglement data base indicate that 3 humpback whale entanglements were attributed to this fishery in 1985. All were considered injured (undefined), but all were released and resighted.

4.4.6. Harpoon/Handline/Rod-and-reel Gear Fisheries

The harpoon/handline/rod-and-reel gear fisheries are listed as category III fisheries under the MMPA because of their low likelihood of interacting with marine mammals. Although NMFS has received a few reports of whales becoming entangled in handline and harpoon gear, further investigation into the incidents suggests that the whales were not injured during the entanglement or were able to easily disentangle themselves.

Turtles have also been known to be captured in rod-and-reel fisheries at relatively low rates. Recreational hook-and-line fisheries have been known to capture and kill sea turtles, including Kemp's ridley turtles. Between 1993 and 1995, 170 Kemp's ridley turtles interacted with recreational hook-and-line gear; resulting in 18 dead, stranded turtles, 51 rehabilitated turtles (5 of which died during rehabilitation), and 96 turtles that were released by fishermen (Cannon and Flanagan 1996).

Similarly, NMFS public sighting database for North Carolina reports interactions between hook-and-line gear and sea turtles from 1988-1996 (NMFS, unpub. data). These data include records of 98 turtles hooked, including 65 loggerhead, 3 green, 12 Kemp's ridley, 3 leatherback, and 15 unidentified turtles. All turtles were released alive but the condition and status of these turtles after their release remains unknown.

4.4.7. AOCTRP and Pelagic Longline Fishery Overlap With Whale Distribution

The regulations implementing the HMS FMP include measures implementing provisions of the Atlantic Offshore Cetacean Take Reduction Plan (AOCTRP), *i.e.*, a requirement that fishermen move after an interaction, a 1-year limit on the length of gear set in the mid-Atlantic statistical area, limited entry, and education/outreach. Currently, the pelagic longline fishery does not generally overlap in time or space with right whale distribution. Additionally, NMFS has no records of observed large whale entanglements in pelagic longline gear; although, due to low levels of observer coverage, it is possible that interactions go unrecorded. NMFS' entanglement database from its northeast region includes records of 5 accounts of humpback whales having been entangled in longline gear of various types (some were released alive by fishermen).

Requiring fishermen to move after an interaction with a sea turtle as well as with a marine mammal (movign for both species is now required by regulations implementing the HMS FMP), is intended to mitigate for the contiguous distribution of marine mammal and sea turtle takes noted in the observer data set. If fishermen comply with this provision, according to industry representatives familiar with the observer data set, there could be up to a 40% reduction in levels of serious injury and mortality of strategic stocks of marine mammals. Hoey (1998) noted that for the NED fishing area, 68.1% of all loggerheads observed entangled in pelagic longline gear were caught on sets with other loggerheads. For leatherbacks, 31.7% were caught on sets with other leatherbacks. Thus, HMS' adoption of this measure as a requirement could substantially decrease incidental take levels with both marine mammals and sea turtles. However, as NMFS noted in the HMS FMP, requiring fishermen to move will be extremely difficult to enforce. NMFS is hopeful that some fishermen may comply voluntarily, and that with the continued promotion of protected species conservation through the educational outreach/workshop efforts discussed below, an increased level of compliance with this requirement may be achieved. However, without an observer onboard there is no way to ensure that fishermen will comply with this provision. It is also unclear what the extent of movement should be – a move in the wrong direction (likely towards warmer water) could lead to even higher probability of interacting with protected species.

Fisherman education and other outreach efforts should help fishermen to become more aware of, and sympathetic to, conservation matters relating to their fishery and to gain a deeper understanding of how their fishing activities affect the marine environment. Also, through a better understanding of protected species biology and habits, dehooking, disentanglement, and resuscitation techniques, *etc.*, fishermen can learn how to decrease their level of impact on protected species. The Captain's Report (Hoey and Moore 1999) outlines several measures that should be quite effective at not only reducing sea turtle take rates, but also should improve the fish catch composition with respect to target species vs. bycatch species and undersized swordfish. Developing fisherman support and understanding of these concepts could lead to actions on the captains' parts which should substantially minimize the incidental take levels for sea turtles. Although it is impossible at this point to estimate how much these outreach efforts may impact incidental take levels, it is hoped that a measurable difference will be achieved. Certainly, the recent NMFS-sponsored sea turtle-longline industry gear workshops and working group meetings have served to underscore the importance of significantly reducing sea turtle interactions in order for the fishery to continue. NMFS believes that, at a minimum, such outreach efforts will foster better communications and understanding and cooperation between the fishermen and NMFS protected species management personnel, which may result in meaningful levels of decrease in protected species bycatch.

Another provision of the AOCTRP is a 1-year limit on the length of gear set in the Mid-Atlantic Bight (to 24 nm from Aug 1 – Nov 30). This provision is also difficult to analyze in terms of potential levels of bycatch reduction. As the HMS FMP notes, of those vessels observed in 1996 and 1997, the average length of mainline fished by pelagic longline fishermen was 20.3 miles and 21.7 miles, respectively. Additionally, the HMS FMP states that some fishermen have indicated they would offset any losses due to this requirement by re-rigging their gear to maintain the same number of hooks per set but on shorter line. If this measure results in effort reduction, as previously believed by AOCTRT members, then lower bycatch numbers may result. However, if this restriction on length of gear does not change the total level of effort in the fishery, then little to no change in take rates for sea turtles would be expected. Although the 1-year effective date for this requirement has passed, the resulting data have not yet been examined to assess its effectiveness.

4.4.8. Effects of the Live Bait Prohibition and Area Closures

There is no information available to determine the possible effects of the prohibition on live bait that were adopted as a measure to protect billfish and swordfish. However, the practice and prohibition extend only to the Gulf of Mexico, where turtle bycatch rates are generally lower than in the NED, NEC, and MAB sampling areas; therefore this provision is not likely to have much effect, if any, on sea turtle bycatch. If visual cues predominate in attracting a sea turtle to gear (*e.g.*, lightstick attraction), this prohibition may help decrease sea turtle bycatch levels.

The results of analyses of the effects of the Charleston Bump, East Florida Coast, and DeSoto Canyon closures, which were implemented in the HMS FMP to reduce bycatch in the pelagic longline fisheries, under an assumption of no redistribution of effort and an assumption of random redistribution of effort (NMFS 2000a). The first analyses, that assumed that effort would not redistribute after a closure, suggest that the number of turtles captured in the fishery would decline by about 1.89%; the latter analyses that assumed that effort would redistribute randomly suggests that turtle bycatch would increase by a maximum of 7.13%.

In addition, the DeSoto Canyon, Florida East Coast, and Charleston Bump closures can be expected to increase the number of leatherback turtles captured and injured in this fishery as fishing effort redistributes away from the closed areas. The combined redistribution of effort model for the combined Gulf of Mexico and southeast U.S. Atlantic coast areas, predicts not more than a 7% increase in turtle takes could result, although NMFS considers even this amount of change is unlikely (NMFS 2000a). However, to err on behalf of the species, NMFS uses this estimate in this analysis. The increase in turtle interactions predicted by the effort redistribution model would increase the number of leatherback and loggerhead turtles released unharmed by 190, with the remainder of the impact resulting in an increase of 4 turtles injured and only 1 turtle killed, both based on fishermen logbook reports (NMFS 2000a).

Based on these analyses, the Gulf of Mexico (DeSoto Canyon) closure would have little effect on the number of sea turtle captured in these fisheries. Most or all of the change will result from the combined Atlantic closures. In particular, it appears that the number of turtles injured or killed (as opposed to the number captured) may be elevated by the proposed Atlantic closures.

4.4.9. Mid-Atlantic Bight (MAB) Closed Area

In June 1999, the HMS FMP closed a 1° X 6° block within the MAB area to the pelagic longline fishery to minimize discards of bluefin tuna in the fishery. The closure was analyzed by NMFS with respect to possible effects on sea turtles. The analysis was performed on a 4° X 4° block at 36° - 40° N and 70° - 74° W, which was the original proposal. A displacement model analysis showed that the change in the number of sea turtles caught in the fishery, due to associated shifts in effort in the longline fishery, depended on the year the data had been collected.

Shifts in effort and estimates of sea turtle take levels were examined for 3 different data sets: 1992-1995 (collectively), 1996, and 1997. The resulting sea turtle take estimates increased 9% (over expected bycatch levels without redistribution) due to the projected redistribution in effort using the 1997 data set, decreased 7% using the 1996 data set, and increased 8% using the combined data set for 1992- 1995. Without controlling for effort between years but simply taking a mean change in take per year and assuming an 8% increase per year in each of the years from 1992-1995 (which may not be valid assumptions, particularly if turtle interactions are highly dependent on the environmental conditions, as potentially indicated by comparing 1996 vs. 1997 data sets), a gross estimate of the mean annual change in sea turtle bycatch resulting from the MAB closure, based on the HMS modeling results, would be a 6% increase in overall levels of turtle caught in the fishery. These data were not reported for specific turtle species, so the effect of shifting effort on particular turtle species is unknown.

The closure that was implemented shifts the area slightly (2°) westward of the area analyzed, but restricts it to a 1° latitudinal band. This lateral compression of the closed area is likely to prevent much of the predicted effort shift into the Grand Banks area, and therefore may reduce subsequent increases in sea turtle takes in this high bycatch area. The final FMP did not become effective until just before this seasonal fishery was to open, so it is doubtful that it had any effect in 1999.

4.4.10. The Proposed Requirement to Use VMS in the Pelagic Longline Fishery

The requirement to use VMS in pelagic longline fisheries is on hold and being reevaluated as a result of the September 25, 2000, ruling by the Court of the District of Columbia. If this requirement is implemented, it should facilitate monitoring of the proposed management measures, encourage greater compliance, and may even provide valuable data on entanglements. These measures, therefore, may slightly reduce sea turtle bycatch, and provide information which could be used in preventing or reducing effects of entanglements in the future (*e.g.,* through gear development strategies or other measures). Extension of the VMS requirement into the shark drift gillnet component of the HMS fisheries is also currently under study and, if implemented, could further enhance overall bycatch reduction efforts.

4.4.11. The Proposed Shark Drift Gillnet Fishery Off Alabama

A proposed shark drift gillnet fishery which would use 8 to 12-in mesh, ≥ 2,000 yard nets and operate off the coast of Alabama, if prosecuted, would add to an unknown degree to the current take levels analyzed. It is possible that fishermen prohibited from longlining would continue to fish in the closure area, using gillnets to target sharks. If this occurs, elevated incidental take levels for protected species, including proportionately more lethal takes of sea turtles, could result. However, this fishery would be state-regulated and would not fall under the jurisdiction of the HMS FMP unless fishermen were also permitted to fish for sharks in federal waters.

5. Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably expected to occur in the action area. 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.

Cumulative effects from unrelated, non-federal actions occurring in the northwest Atlantic may affect sea turtles, marine mammals, and their habitats. Stranding data indicate marine mammals and sea turtles in Atlantic waters die of various natural causes, including cold stunning (in the case of sea turtles), as well as human activities, such as incidental capture in state fisheries, ingestion of or entanglement in debris, ship strikes, and degradation of nesting habitat. The cause of death of most marine mammals and turtles recovered by the stranding network is unknown.

Numerous fisheries in State waters along the Atlantic coast have been known to adversely affect threatened and endangered sea turtles and marine mammals. The past and present impacts of these fisheries have been discussed in the Environmental Baseline section of this biological opinion. Most of these fisheries will be prosecuted concurrent with the fisheries prosecuted under the Atlantic Highly Migratory Species Fishery Management Plan and can be expected to continue into the future. The future effects of these fisheries will be discussed in this section of this Opinion.

5.1. Trawls

Numerous trawl fisheries in State waters along the Atlantic coast have adversely affected threatened and endangered sea turtles in the past and can be expected to adversely affect sea turtles in the future. A detailed summary of the impacts of the U.S. shrimp trawl fishery and the Mid-Atlantic winter trawl fishery can be found in TEWG (1998, 2000) and NMFS SEFSC (2001). Other bottom trawl fisheries that may impact sea turtles are the horseshoe crab fishery in Delaware (Spotila *et al.* 1998) and the whelk trawl fishery in South Carolina (S. Murphy, pers. comm. to J. Braun-Mcneill, November 27, 2000) and Georgia (M. Dodd, pers. comm. to J. Braun-McNeill, December 21, 2000). In South Carolina, the whelk trawling season opens in late winter and early spring when offshore bottom waters are > 55ºF. One criterion for closure of this fishery is water temperature: whelk trawling closes for the season and does not reopen throughout the state until 6 days after water temperatures first reach 64ºF in the Fort Johnson boat slip. Based on the South Carolina Department of Natural Resources Office of Fisheries Management data, approximately 6 days will usually lapse before water temperatures reach 68ºF, the temperature at which sea turtles move into state waters (D. Cupka, pers. comm.). From 1996-1997, observers onboard whelk trawlers in Georgia reported a total of 3 Kemp's ridley, 2 green and 2 loggerhead sea turtles captured in 28 tows for a CPUE of 0.3097 turtles/100ft net hour. As of December 2000, TEDS are required in Georgia state waters when trawling for whelk (*Ibid*.).

The North Carolina Observer program documented 33 flynet trips from November through April of 1991-1994 and recorded no turtles caught in 218 hours of trawl effort. However, a NMFS- observed vessel fished for summer flounder for 27 tows with an otter trawl equipped with a TED and then fished for weakfish and Atlantic croaker with a flynet that was not equipped with a TED. They caught 1 loggerhead in 27 TED-equipped tows and 7 loggerheads in 9 flynet tows without TEDs. In addition, the same vessel using the flynet on a previous trip took 12 loggerheads in 11 out of 13 observed tows targeting Atlantic croaker. A slight potential exists for interaction between this fishery and humpback whales, particularly in the mid-Atlantic, but no documentation of such interactions is available for this consultation.

In the future, we would expect these fisheries to continue at current levels of effort, and would expect the fisheries to capture, injure, or kill similar numbers of loggerhead turtles.

5.2. Hook and Line

In addition to trawl fisheries managed by States along the Atlantic coast, numerous hook and line fisheries have also adversely affected threatened and endangered sea turtles in the past and can be expected to adversely affect sea turtles in the future. Loggerheads are known to bite a baited hook, frequently ingesting the hook. Leatherbacks and greens also bite baited hooks. Hooked turtles have been reported by the public fishing from boats, piers, and beach, banks, and jetties and from commercial fishermen fishing for reef fish and for sharks with both single rigs and bottom longlines. A detailed summary of the impact of hook and line incidental captures to loggerhead sea turtles can be found in the TEWG reports (1998, 2000) and NMFS SEFSC (2001).

In the future, we would expect recreational hook and line fisheries to continue at current levels of effort, and would expect the fisheries to capture, injured, or kill similar numbers of loggerhead, leatherback, and green turtles.

5.3. Pound Nets

Pound nets are a passive, stationary gear that are known to incidentally capture loggerhead sea turtles in Massachusetts (R. Prescott pers. comm.), Rhode Island, New Jersey, Maryland (W. Teas pers. comm.), New York (Morreale and Standora 1998), Virginia (Bellmund *et al*. 1987) and North Carolina (Epperly *et al.* 2000). Although pound nets are not a significant source of mortality for loggerheads in New York (Morreale and Standora 1998) and North Carolina (Epperly *et al.* 2000), they have been implicated in the stranding deaths of loggerheads in the Chesapeake Bay from mid-May through early June (Bellmund *et al.* 1987). The turtles were reported entangled in the large mesh (>8 inches) pound net leads. (see NMFS 2001).

In the future, we would expect State-managed pound net fisheries to continue at current levels of effort, and would expect the fisheries to capture, injured, or kill similar numbers of loggerhead turtles.

5.4. Gillnets

A detailed summary of the gillnet fisheries currently operating along the mid- and southeast U.S. Atlantic coastline that are known to incidentally capture loggerheads can be found in the TEWG reports (1998, 2000) and NMFS SEFSC (2001). Although all or most nearshore gillnetting in state waters of South Carolina, Georgia, Florida, Louisiana, and Texas is prohibited by state regulations, gillnetting in other states' waters and in federal waters does occur. Of particular concern are the nearshore and inshore gillnet fisheries of the mid-Atlantic that operate in state and federal waters off Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina. Incidental captures in these gillnet fisheries (both lethal and non-lethal) of whales and loggerhead, leatherback, green and Kemp's ridley sea turtles have been reported (W. Teas, pers. comm.; J. Braun-McNeill pers. comm.). In addition, illegal gillnet incidental captures have been reported in South Carolina, Florida, Louisiana and Texas.

In the future, we would expect gillnet fisheries in mid-Atlantic coastal States to continue at current levels of effort, and would expect the fisheries to capture, injured, or kill similar numbers of loggerhead, leatherback, green, and Kemp's ridley turtles. With the information available during the writing of this opinion, it is impossible to quantify the effects of these fisheries on sea turtles.

5.5. Other U.S. Fisheries

Incidental captures of loggerheads in fish traps set in Massachusetts, Rhode Island, New York, and Florida have been reported (W. Teas, pers. comm.). Although no incidental captures have been documented from fish traps set in North Carolina and Delaware (Anon 1995), they are another potential anthropogenic impact to loggerheads and other sea turtles. Lobster pot fisheries are prosecuted in Massachusetts (Prescott 1988), Rhode Island (Anon 1995), Connecticut (Anon 1995) and New York (S. Sadove, pers. comm.). Although they are more likely to entangle leatherback sea turtles, lobster pots set in New York are also known to entangle loggerhead sea turtles (*Ibid*.). We have no data on the number of turtles incidentally captured in these fisheries in other states. 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.). We have no reports of turtle mortalities associated with this fishery (NMFS SEFSC 2001).

Humpback whale entanglements occur in relatively high numbers in Canadian waters. Reports of collisions with fixed fishing gear set for groundfish around Newfoundland averaged 365 annually from 1979 to 1987 (range 174-813). An average of 50 humpback whale entanglements (range 26-66) were reported annually between 1979 and 1988 and 12 of 66 humpback whales that were entangled in 1988 died (Lien *et al.* 1988). Right whale entanglements also occur in Canadian waters, although not as frequently as for humpback whales. Many entanglements observed in U.S. waters may have originated in Canadian waters. Unless gear is specifically marked and such marks are documented, it is often impossible to determine the origin of the gear.

5.6 Vessel Interactions

Wiley *et al.* (1995) showed that in the mid-Atlantic area (between Chesapeake Bay, Virginia, and Cape Hatteras, North Carolina), of the stranded humpback whales for which the cause of death was determinable, 30% were attributed to ship strikes and 25% to injuries consistent with entanglement in fishing gear. This indicates that vessel interactions are having an impact upon whale populations along this portion of the coast, as well as in right whale concentration areas. Because most of the whales involved in these interactions are juveniles, areas of concentration for young or newborn animals are particularly important. This also raises concerns that, with such mortality focused on one age-class of the population, future recruitment to the breeding population may be affected.

Ship strikes have been identified as a significant source of mortality to the Western Atlantic stock of right whales (Kraus 1990) and are also known to impact all other endangered whales. Specifically, commercial and private vessels may affect humpback, fin, sperm, and right whales. Small vessel traffic also kills or injures threatened and endangered sea turtles in the action area.

The ports of Jacksonville and Port Everglades, Florida; Baltimore, Maryland; Wilmington, Delaware; Philadelphia, Pennsylvania; New York, New York; and Boston, Massachusetts support some of the country's strongest maritime economies. Commercial shipping traffic in Massachusetts Bay is estimated at 1,200 ship crossings per year with an average of 3 per day. About 17 million tons of waterborne cargo pass through the Port of Jacksonville, Florida which receives about 1,600 vessels each year moving between the U.S. and South America, Europe, and the Caribbean. About 4.8 million tons (short tons) pass through the Port of Wilmington, Delaware which receives about 400 vessels each year. About 56 million tons of waterborne cargo passed through the Port of New York in 1998. About 1.3 million tons of general cargo, 1.5 million tons of bulk cargo, and 12.8 million tons of bulk fuel cargo pass through the Port of Boston, Massachusetts, which receives more than 62 ship calls, 350 container vessels, and 1,700 bulk cargo vessels each year. In addition, about 60 cruise vessels sail from the Port of Boston each year. (See internet websites for each named port.)

In southeastern waters, shipping channels associated with Jacksonville and Port Canaveral, Florida, bisect the area that contains the most concentrated whale sightings within right whale critical habitat. These channels and their approaches serve commercial shipping ports and two military bases. All of these channels require periodic maintenance dredging by the Corps of Engineers and, at times, more extensive dredging is conducted to support port expansion or to allow for larger military vessels. These commercial ports are growing, with the port of Jacksonville, one of the busiest ports on the east coast, undergoing major expansion along with several other east coast ports vying for designation as “megaports” to attract Panamanian ex-vessel traffic. Expansion of these ports requires section 7 consultations.

In Massachusetts Bay alone, about 20 whale watch companies comprising 40-50 boats conduct several thousand trips from April to September, with the majority of effort in the summer season. More than 280 commercial vessels fish on Stellwagen Bank. Sportfishing contributes more than 20 vessels per day from May to September. In addition, an unknown number of private recreational boaters frequent Massachusetts and Cape Cod Bays.

It is possible that the combination of these activities may cause sublethal effects to protected species that could prevent or slow a species' recovery; such effects are currently unknown. Various initiatives have been planned or undertaken to expand or establish high-speed watercraft service in the northwest Atlantic, including one service between Bar Harbor, Maine, and Nova Scotia with a vessel operating at higher speeds than established watercraft service. The Bar Harbor–Nova Scotia high speed ferry conducted its first season of operations in 1998. The operations of these vessels and other high-speed craft may adversely affect threatened and endangered whales and sea turtles. NMFS and other member agencies of the Northeast Implementation Team for the Recovery of the Northern Right Whale will continue to monitor the development of the high-speed vessel industry and its potential threats to listed species and critical habitat. Recent whale strikes resulting from interaction with whale watch boats and recreational vessels have also been recorded.

NMFS expects commercial traffic into and out of these ports to continue into the foreseeable future. The best scientific and commercial data available provide no specific information on the degree of risk this level of commercial traffic poses to endangered whales in the action area, but this level of commercial traffic is expected to pose a risk of ship strikes that would continue to kill or seriously injure whales in numbers similar to those observed between 1994 and 1999: 1 dead blue whale, 1 dead sei whale, 2 dead fin whales, and at least 6 dead right whales.

5.7 Dredging

In most areas of the U.S., annual dredging to accommodate commercial shipping occurs in the nearshore approaches to most of the major ports. Dredging may pose a threat to whales due to increased vessel traffic. This entails dredge vessel movement back and forth between dredging and dumping sites. However, these vessels in general are relatively slow moving and, under ESA section 7 consultations conducted on various dredging activities, various measures to mitigate this concern have been implemented, including posting of dedicated whale observers in high whale-use areas and seasons. Additionally, dredging may result in increased vessel traffic as deepening and/or widening of ports or channels attracts more and larger vessels to use these areas. Dredging is responsible for injury and mortality of sea turtles and is the subject of a number of mitigation measures contained in various Opinions conducted on these activities.

5.8 Pollutants, Oil, and Marine Debris

These factors are described in the environmental baseline and are very difficult to assess and quantify, but all would be expected to continue into the foreseeable future. They would be expected to continue to contribute to the habitat and physiological stresses on these populations (see NMFS SEFSC, 2001 and environmental baseline for more detail). This category of potential effects includes atmospheric loading of pollutants such as PCBs, storm water runoff from coastal towns, groundwater discharges, and river input and runoff, nutrient loading from land-based sources such as coastal community discharges, bioaccumulation of the neurotoxins, oil spills from tankers, illegal discharge of oil and tar from vessels discharging bilge water and marine debris that will persist in the action area despite MARPOL prohibitions.

6.0 Integration and Synthesis of Effects

In the *Approach to the Assessment* section of this Opinion, it was noted that the jeopardy analysis proceeds in three steps: (1) identification of the probable direct and indirect effects of an action on the physical, chemical, and biotic environment of the action area; (2) determination of whether there is reasonable expectation that threatened or endangered species will experience reductions in reproduction, numbers, or distribution in response to these effects; and (3) determination of whether any reductions in a species' reproduction, numbers, or distribution (identified in the second step) can be expected to appreciably reduce a listed species' likelihood of surviving and recovering in the wild.

The *Status of Affected Species*, *Critical Habitat,* and *Environmental Baseline* section of this Opinion discusses the natural and human-related phenomena that caused populations of listed species to become threatened or endangered and may continue to place their populations at high risk of extinction.

The present section of this Opinion examines the physical, chemical, and biotic effects of the fisheries associated with the Atlantic HMS FMP to determine (a) if those effects can be expected to reduce the reproduction, numbers, or distribution of threatened or endangered species in the action area, (b) determine if any reductions in reproduction, numbers, or distribution would be expected to reduce the species' likelihood of surviving and recovering in the wild, and (c) if a reduction in a species' likelihood of surviving and recovering in the wild would be appreciable.

6.1. Integration and Synthesis of Effects on Loggerhead Turtles

The proposed U.S. HMS fisheries can be expected to capture, injure, or kill loggerhead sea turtles. Most of the loggerhead turtles that would be harmed incidental to the prosecution of fisheries under the HMS FMP would be affected by longline fisheries. Most interactions between the U.S. longline fleet and loggerhead and leatherback turtles would continue to occur from the Mid-Atlantic Bight northward (NMFS SEFSC 2001), particularly the Northeast Distant statistical area. The highest number of interactions would be expected to occur in the 3rd quarter of the year.

Based on previous patterns of interactions between the fishery and sea turtles, the U.S. pelagic longline fishery would be expected to capture, on average, about 986 loggerhead turtles annually[2] in the Gulf of Mexico, Caribbean, and Atlantic Ocean. Most of these turtles would be in the pelagic, immature stage of their lives. Genetics analyses of 16 loggerhead turtles caught on the Grand Banks indicated that the animals shared haplotypes with animals nesting in the southeastern U.S., as well as in Mexico and Greece (Encalada *et al.* 1998 *in* NMFS SEFSC 2001). Unfortunately, the small sample size makes it difficult to determine the proportional contribution of the different nesting aggregations to the loggerhead turtles caught in the HMS fisheries. However, if loggerhead turtles caught in the HMS fisheries are captured in proportion to their distribution on foraging grounds in the north Atlantic Ocean, then about 71-72% of the turtles caught in the longline fishery would be from the South Florida nesting aggregation, 17-19% would be from the northern nesting aggregation, and 10-11% would be from the Quintana Roo, Mexico nesting aggregation (see *Status of the Species* section for relative distribution of loggerhead turtles).

Loggerhead turtles would be expected to be captured through several interactions with longline gear. Table 8 below summarizes these based on type of interaction and expected mortality. In Section 4.4.1.3.1, data from 1992-1999 were averaged, resulting in an annual average estimate of 986 loggerhead incidentally taken in the longline fishery. Table 7 and accompanying text in section 4.4.1.3.3 explained the percentages expected to be hooked or captured in various ways based on 1999 and 2000 data. Combining this information in a calculation with expected percent for mortality based on the interaction type from the February 16, 2001 policy memo, provides an estimate of the number of turtles expected to be killed or injured annually. The average number of loggerhead turtles that have been estimated as taken incidental to the fisheries between 1992 and 1999 (986 loggerheads) is first multiplied by a percent derived from the numbers in Table 7 and the result is them multiplied by the percent mortality expected for that category.

Table 8. Estimates of loggerheads by interaction type.

Avg. 986 loggerheads taken annually	Observed loggerheads 1999	Observed loggerheads 2000	‘99 Annual estimate for this category (#turtles)	‘00 Annual estimate for this category (#turtles)	‘99 Annual mortality estimate for category (#turtles)	‘00 Annual mortality estimate for category (#turtles)
ingested (42% mort.)	10/64(16%)	15/50 (30%)	158	296	66	124
beak/mouth (27% mort.)	44/64 (69%) *	26/50 (52%) #	680	513	184	138
beak/mouth (42% mort)	44/64 (69%) *	26/50 (52%) #	680	513	286	215

* “beak or mouth” category plus 36 from unknown beak or mouth”-these were added in because observer comments list 35 of these hook in mouth, 1 hooked in beak. One turtle spit hook which was not included in estimate.

[2] This estimate was derived by dividing the total number of loggerhead turtles that have been estimated as taken incidental to the fisheries between 1992 and 1999 by 8 (the number of years used to derive the estimate). See discussion of estimated incidental capture rates in section 4.4.1.1.

#"beak or mouth" category plus 3 from "head or beak" as observer comments show these as hooked in beak.

Two scenarios are given for "beak/ mouth" because data is not exact enough to determine if hooking was in the internal soft tissue of mouth –the distinction in the policy memo between 27 and 42%.

In addition, the DeSoto Canyon, Florida East Coast, and Charleston Bump closures can be expected to increase the number of turtles captured and injured in this fishery as fishing effort redistributes away from the closed areas. The combined redistribution of effort model for the combined Gulf of Mexico and southeast U.S. Atlantic coast areas, not more than a 7% increase in turtle takes could result from a redistribution in fishing effort, although NMFS considers even this amount of change is unlikely (NMFS 2000a). However, to err on behalf of the species, NMFS uses this estimate in this analysis. The increase in turtle interactions predicted by the effort redistribution model shows an increase in the number of loggerhead turtles taken by 69, resulting in 10 mortalities, based on logbook reports and estimates provided in the FSEIS (NMFS 2000a).

The bottom longline fishery for sharks could capture as many as 207 to 517 turtles each year (Section 4.4.2), killing as many as 40 to 99 turtles. The U.S. shark drift gillnet fishery, which has had inconsistent observer coverage, can be expected to capture small numbers of loggerhead turtles. Harpoon, handline, and rod-and-reel fisheries, which have had no observer coverage, can be expected to capture small numbers of loggerhead turtles over a 5- or 10-year period, although some years may pass with no interactions at all. A small fraction of the loggerhead turtles captured in these fisheries will be injured, seriously injured, or killed.

Summary of Effects on Loggerhead Turtles.
It is reasonable to expect that the proposed Atlantic HMS fisheries (longline, shark drift gillnet, and redistribution from closures) could capture as many as 1417 pelagic, immature loggerhead turtles in a year (based on the average of 1999, 2000 data and an average of high and low mortality rates based on type of hooking interaction) and could kill as many as 381 of them (this is an average estimate based on only two years data, NMFS would expect the actual number of loggerhead turtles killed in a particular year to be less than or greater than this estimate). Assuming that some of these turtles would be female, NMFS would also conclude that these deaths would reduce the species' reproduction in addition to reducing their numbers.

Trend information on loggerhead sea turtles indicates that the Florida subpopulation had increased at about 5% per year from 1978-1990, but this growth rate appears to have slowed to about 4% per year since 1990 (NMFS SEFSC 2001). Conversely, the northern population of loggerhead turtles is relatively small and is either stable or declining (TEWG 1998, 2000; NMFS SEFSC 2001). The number of nests in the northern subpopulation from 1989 to 1998 ranged from 4,370 to 7,887 with a 10-year mean of 6,247 nests. With each female producing an average of 4.1 nests in a nesting season, the average number of nesters per year in the northern subpopulation was 1,524 (range 1066-1924). The total nesting and non-nesting female population may be estimated by factoring in an average re-migration rate of 2.5 years for an average estimate of 3,810 adult females in the northern subpopulation (range 2,665 - 4,810) (TEWG 1998, 2000).

Over the long term (for example, the amount of time it would take for a hatchling born this year to recruit into the adult population) capturing and killing this many loggerheads given those nester numbers would be expected to appreciably reduce the loggerhead sea turtles' likelihood of surviving and recovering in the wild, particularly given the status and trend of loggerhead turtle populations in the Atlantic basin. When added to the number of sea turtles that are injured or killed through other human activities, including other federal and state fisheries, these injuries and mortalities would be expected to have population-level effects. When considered cumulatively, the annual death or injury of these numbers of turtles would be even more significant: in the time if would take for a hatchling to recruit into the adult population (about 25 years), the fisheries would be expected to injure more than 21,000 loggerhead turtles, killing more than 9,000 of them.

Removing these numbers of pelagic, immature loggerhead turtles from nesting populations would be expected to appreciably reduce the population's growth rate. This would be particularly true for the northern nesting subpopulation. NMFS' SEFSC (2001) modeled the effects of changes in the survival rates of pelagic juvenile loggerhead turtles on population trajectories. Based on these models, decreases in pelagic juvenile survival reduce or negate the benefits of increased survival of small, benthic loggerhead turtles (which is being achieved using turtle exclusion devices); if the survival rates of a population's pelagic, immature loggerheads decreased by 10%, the population would decline (NMFS SEFSC 2001). This would appreciably diminish this population's likelihood of surviving in the wild, although it is impossible to quantify the magnitude of this effect. Given the size of loggerhead turtle populations in the western Atlantic Ocean, particularly the northern subpopulation, and the effects of other fisheries and sources of mortalities on the various nesting aggregations, this would appreciably reduce the population's size and reproductive capacity in a way that would be expected to appreciably decrease this population's likelihood of surviving and recovering in the wild.

6.2. Integration and Synthesis of Effects on Leatherback Turtles

Based on past patterns, the proposed U.S. HMS fisheries can be expected to capture, injure, or kill leatherback sea turtles. Most of the leatherback turtles that would be harmed incidental to the prosecution of fisheries under the HMS FMP would be affected by longline fisheries. The highest numbers of leatherbacks taken in HMS fisheries would occur in the fall in the pelagic longline component in the Northeast Distant, although substantial numbers of leatherback turtles are captured in the Mid-Atlantic Bight, Northeast Coastal, and the Gulf of Mexico statistical areas.

Based on data from previous interactions between the U.S. pelagic longline fishery and sea turtles, the fishery would be expected to capture an average of 796 leatherback turtles annually[3]. Leatherback turtles captured or killed in the longline fishery off the northeastern U.S. would probably have carapace lengths less than 100 cm, while those captured or killed off the southeast U.S., the Gulf of Mexico, and the Caribbean could be any length.

The greatest percentage of these leatherback turtles would be hooked in their flippers, head, neck, carapace, or plastron (38%) with smaller percentages hooked in beak or mouth (20%) (See Table 9). In addition, the DeSoto Canyon, Florida East Coast and Charleston Bump closures can be expected to increase the number of turtles captured and injured in this fishery if fishing effort redistributes away from

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[3] This estimate was derived by dividing the total number of leatherback turtles that have been estimated as taken incidental to the fisheries between 1992 and 1999 and dividing that value by 8 (the number of years used to derive the estimate). See section 4.4.1.1 for estimated incidental capture rates.

the closed areas. Under the combined redistribution of effort model, a 7% increase in leatherback turtle takes could occur. That increase could be a high as 56 turtles annually with 4 mortalities.

The bottom longline fishery for sharks could capture about 13 to 34 leatherback turtles each year. No leatherback turtle takes have been recorded in the tuna purse seine fishery, the harpoon fishery, or other hand gear fisheries. Rod-and-reel fisheries, in general, rarely interact with leatherbacks, and no such interactions have specifically been documented in HMS fisheries.

It is reasonable to expect that HMS Fisheries combined could capture as many as 875 leatherback turtles annually, killing as many as 183 of them (based on the average of 1999, 2000 data and an average of high and low mortality rates based on type of hooking interaction--these are average estimates--NMFS would expect the actual number of leatherback turtles killed in a particular year to be less than or greater than this estimate). Assuming that some of these turtles would be female, NMFS would also conclude that these deaths would reduce the species' reproduction in addition to reducing their numbers.

The largest known nesting aggregation of the leatherback turtles in the western North Atlantic Ocean occurs in French Guiana (NMFS SEFSC 2001). This may be the largest nesting aggregation of leatherback turtles in the world and has been declining at about 15% per year since 1987. From 1979 to 1986, the number of nests in this aggregation increased at about 15% annually. The number of nests in Florida and the U.S. Caribbean has been increasing at about 10.3% and 7.5%, respectively, per year since the early 1980s but the magnitude of nesting is much smaller than that along the French Guiana coast. Given that Atlantic Ocean subpopulations exhibit the same life history characteristics and that longline fisheries are not likely to discriminate between subpopulations, then it is expected that if longline fishing were causing the declines in French Guiana, declines would be measured in other nesting subpopulations. While the longline fishery, both U.S. and foreign, and the U.S. shrimp trawl fishery may not be the immediate cause in declines in nesting in French Guiana, the number of leatherback turtles captured and killed in these fisheries would be expected to contribute to these declines.

In addition, the mortality rate of adult, female leatherback turtles has increased over the past ten years, decreasing the number of nesting females. Any mortalities in the U.S. longline fishing would be expected to have the same effects on all leatherback turtle nesting aggregations in the western North Atlantic Ocean, regardless of the beach or origin (NMFS SEFSC 2001).

Table 9. Estimates of leatherbacks by interaction type.

Avg. 796 leatherbacks taken annually	Observed leatherbacks 1999	Observed leatherbacks 2000	'99 Annual estimate for this category (#turtles)	'00 Annual estimate for this category (#turtles)	'99 Annual mortality estimate for category (#turtles)	'00 Annual mortality estimate for category (#turtles)
external * (27% mort.)	17/45 (38%)	21/32 (66%)	302	525	82	142
beak/mouth (27% mort.)	9/45(20%) #	4/32 (12%)	159	96	43	26
beak/mouth (42% mort)	9/45 (20%) #	4/32(12%)	159	96	67	40

* includes flipper, head or neck (ext) carapace or plastron

includes 1 from beak or mouth plus 8 from "unknown beak or mouth" as observer form comments showed one spit hook.

Therefore, killing as many as 183 of leatherback sea turtles in HMS fisheries could be contributing to declines in leatherback turtle populations in the western Atlantic Ocean. The cumulative, long-term effects of these losses over the time it would take the survivors of the current (2001) cohort of eggs to recruit into the adult, breeding population (approximately 9 years) would mean that up to1647 leatherback turtles could be killed in interactions with the HMS fisheries during this period. Additionally, absolute populations are relatively small. Spotila *et al.* (1996) have estimated the French Guiana/Suriname nesting female population at 5,100- 9,500 per year; and Caribbean populations at 1,400 to 1,800 nesters per year.

Over the long term (for example, the amount of time it would take for a hatchling born this year to recruit into the adult population) these injuries and mortalities would be expected to appreciably reduce the leatherback sea turtles' likelihood of surviving and recovering in the wild, particularly given the status and trend of leatherback turtle populations in the Atlantic basin. In the time if would take for a hatchling to recruit into the adult population (about 9 years), the fisheries would be expected to injure more than 4,437 leatherback turtles, killing more than 1,600 of them. Removing these numbers of leatherback turtles from declining populations would be expected to appreciably reduce the population's growth rate, which would, in turn, reduce the population's ability to recover from decline. This would appreciably diminish this population's likelihood of surviving in the wild, although it is impossible to quantify the magnitude of this effect. Given the trend of leatherback turtle populations in the western Atlantic Ocean and the effects of other fisheries and sources of mortalities on the various nesting aggregations, this would appreciably reduce the population's size and reproductive capacity in a way that would be expected to appreciably increase this population's risk of extinction.

6.3. Integration and Synthesis of Effects on Other Sea Turtles

Most reports of green, Kemp's ridley, or hawksbill turtles being captured or killed in the pelagic longline fishery are probably misidentifications (Witzell 1999), so it is difficult to assess the effects of this fishery on these turtle species. While some of these species may be captured or killed in the pelagic longline fisheries, their numbers appear to be very small. We would not expect more than 35 individuals of these species to be captured in the proposed HMS fisheries in a given year.

NMFS has no reports of Kemp's ridley or green turtles being captured in any other Atlantic HMS fisheries; although, one hawksbill turtle was captured in the shark drift gillnet fishery in March 2001. These species have been captured in rod-and-reel fisheries, but not those associated with species covered by the HMS FMP. Because so few of these species are captured in the HMS fisheries, we do not believe the fisheries would be expected to reduce their reproduction, numbers, or distribution. Therefore, the HMS fisheries would not be expected to appreciably reduce their likelihood of surviving and recovering in the wild.

6.4 Integration and Synthesis of Effects on Whales

The information available at this time indicates that pelagic longline interactions with large whales are rare and, to date, no serious injuries or mortalities of large whales have been recorded. Areas of large whale concentration do not generally coincide with HMS fishing areas, particularly the more coastally-distributed right and humpback whales. Fin and sperm whales are rarely involved in entanglements. If HMS closures redistributed fishing effort into areas that are not currently fished, this could be a cause for concern. However, this is not likely to occur, especially in the case of right whales, because to differing habitat preferences between these whales and the fish species targeted by HMS fisheries. The shark gillnet fishery does have potential for interaction, but NMFS believes that the existing provisions of the ALWTRP minimize this potential to the point of only a very remote possibility.

Because interactions between vessels and gear involved in HMS fisheries and threatened and endangered whales are rare, NMFS does not expect the proposed fisheries would reduce the reproduction, numbers, or distribution of threatened or endangered whale species in the action area. Because the proposed HMS fisheries would not be expected to reduce the reproduction, numbers, or distribution of listed whales, the fisheries would not be expected to reduce the whales' likelihood of surviving or recovering in the wild.

6.5. Right Whale Critical Habitat

Actions that may adversely affect the value of designated critical habitat for the northern right whale are evaluated separately in biological opinions, regardless of whether right whales are present within the critical habitat when the adverse effects occur. The proposed HMS fisheries may diminish the value of the critical habitat that has been designated for the northern right whale in two ways: (a) the distribution and relative abundance of gear associated with the proposed fisheries may diminish the value of critical habitat by increasing the risk of entanglements and mortalities and (b) the fishery may diminish the value of designated critical habitat by reducing the availability of right whale prey within critical habitat. However, as right whales feed primarily on copepods, the latter is highly unlikely.

The areas designated as critical habitat for right whales in the Northeast (including portions of Cape Cod Bay, Stellwagen Bank, and the Great South Channel) are not currently frequented by participants in HMS fisheries. As discussed above, the Atlantic Offshore Take Reduction Team recommended closure of right whale critical habitat areas to pelagic driftnet and longline gear, to prevent future expansion of effort into these currently unfished areas. NMFS has partially addressed this recommendation by prohibiting pelagic driftnet as an allowable gear-type in swordfish and tuna fisheries. Because there is currently little or no overlap between right whales and HMS fisheries in these northeast critical habitat areas, no effect is expected.

The area designated as critical habitat for right whales in the Southeast overlaps with the area in which the Southeast U.S. shark drift gillnet fishery is prosecuted. Concern regarding increased risk of entanglement and mortality was addressed in the HMS FMP, minimizing the likelihood that the fishery will appreciably diminish the value of designated critical habitat for both the survival and recovery of the northern right whale, by implementing the shark fishery time-area closure and the 100% observer requirement of the May 27, 1997, Opinion (or VMS alternative provided under the June 30, 2000, Opinion). This assumes that the risk of the fishery co-occurring with right whales is greatly diminished, and that the presence of observers (when and where the fishery is allowed to operate) will both help to avoid an entanglement, as well as ensure that disentanglement experts are contacted immediately in the unlikely event that any right whales are entangled. Because this 100% observer requirement was not fully implemented in 1999, combining a lower level of observer coverage with VMS monitoring would ensure compliance with the closed areas when observers are unavailable, as well as provide insurance that all shark gillnet effort in the area is monitored. Monitoring compliance with the closure provision via VMS and, other than lower-level observer coverage for monitoring purposes, requiring observers only on those vessels electing to fish with strike nets in the closure area would still ensure that the primary calving area is free of shark gillnet gear except when used in strike fashion using spotter planes and in the presence of observers who would still be able to ensure disentanglement experts would be contacted in the unlikely event of an entanglement. No fishermen so far have elected to fish in the closed area with the strike (*i.e.*, run-around gillnet) method.

The Florida East Coast and Charleston Bump longline closures off the southeastern U.S. encompass the southeastern right whale critical habitat and surrounding areas where right whales have been sighted during the winter calving season; therefore, this action will further lessen the potential for entanglement risk of longline gear to right whales or overwintering humpbacks.

The availability of right whale prey (copepods) is not a concern in the Southeast and copepod abundance would not be expected to be affected by the HMS fisheries. Also, right whales do not feed extensively while on the southern end of their migratory cycle. Thus, the HMS fisheries are not expected to appreciably diminish the value of designated critical habitat by reducing the availability of right whale prey within critical habitat.

7.0 Conclusion

After reviewing the current status of the northern right whale, the humpback, fin and sperm whales, and leatherback, loggerhead, green, hawksbill, and Kemp's ridley sea turtles, the environmental baseline for the action area, the effects of the continued operation of the fisheries managed under the Atlantic HMS FMP, the record of compliance with requirements of previous Opinions on HMS fisheries, and probable cumulative effects, it is NMFS' biological opinion that:

(1) continued operation of the **Atlantic pelagic longline fishery is likely to jeopardize the continued existence of the leatherback sea turtle and the loggerhead sea turtle**; and
(2) continued operation of the Atlantic pelagic longline fishery may affect, but is not likely to jeopardize the continued existence of the right whale, humpback whale, fin whale, sperm whale, or Kemp's ridley, green, or hawksbill sea turtle; and
(3) continued operation of the Southeast drift gillnet fishery for sharks, the bottom longline fishery, the purse seine fishery, and the harpoon, hand gear, rod and reel, *etc.* fisheries in the Atlantic may adversely affect but are not likely to jeopardize the continued existence of the right whale, humpback, fin, or sperm whales, or Kemp's ridley, green, loggerhead, hawksbill or leatherback sea turtles; and
(4) components of the Atlantic HMS fisheries are not likely to destroy or adversely modify critical habitat designated for the right whale.

8.0 Reasonable and Prudent Alternative

This Opinion has concluded that the Atlantic Pelagic Longline Fisheries for Swordfish, Tuna, and Shark, in the U.S. Atlantic, as proposed, are likely to jeopardize the continued existence of loggerhead and leatherback sea turtles. The clause "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).

Regulations implementing section 7 of the ESA (50 CFR §402.02) define reasonable and prudent alternatives (RPAs) as alternative actions, identified during formal consultation, that: (1) can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; (3) are economically and technologically feasible; and (4) would, NMFS believes, avoid the likelihood of jeopardizing the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

This biological opinion concluded that fisheries prosecuted under the HMS FMP, particularly the pelagic longline fishery, are likely to jeopardize loggerhead and leatherback sea turtles. To address the adverse effects to loggerhead and leatherback populations, NMFS must undertake management measures and other conservation measures, as necessary, to reduce both the number of loggerhead and leatherbacks that are incidentally captured, injured or killed in pelagic longline fisheries and the expected impacts from such fisheries to an extent that the likelihood of jeopardy is avoided and authorization of longline fishing activities prosecuted under the HMS Atlantic FMP can continue. The following describes the context and considerations upon which NMFS developed an RPA to avoid jeopardy for loggerhead and leatherback turtles as a result of the continued operation of the HMS Atlantic longline fishery.

Throughout this Opinion, NMFS has recognized that threatened and endangered sea turtles face a risk of global extinction because of a wide array of human activities and natural phenomena. NMFS also recognizes that other human activities and natural phenomena, such as the number of turtles killed by foreign fleets, pose a much larger and more serious threat to the survival and recovery of sea turtles than U.S. HMS fisheries in the Atlantic Ocean. Further, this Opinion recognizes that sea turtles will not recover without addressing the full range of human activities and natural phenomena that could cause these animals to become extinct in the foreseeable future.

The best method of reducing the numbers of sea turtles captured, injured, or killed in the U.S. HMS fisheries may be area closures where interaction rates are highest. In their review of existing data, NMFS' Southeast Fisheries Science Center analyzed the effectiveness of targeted, small area closures for reducing the number of sea turtle captured by the U.S. fleet concluded that only comprehensive, large area closures would be effective (NMFS SEFSC 2001). However, implementing area closures could increase the number of turtles captured and killed in longline fisheries in the north Atlantic Ocean. The majority of turtles captures by the U.S. fleet occur in high sea areas that can also be fished by foreign vessels. Other fishing nations are not likely to adopt area closures imposed by NMFS and NMFS has no legal authority and limited leverage to compel other nations to implement closures. As a result, the tuna and swordfish quota that is not caught by U.S. vessels might be reassigned to another ICCAT country, which would increase the effort of foreign vessels in areas closed to the American fleet which could increase the number of turtles captured and killed in the fishery. Nonetheless, closure of a large area to HMS fisheries immediately eliminates the bycatch attributable to those vessels, and allows those individual turtles the chance to survive to adulthood and reproduce.

To prevent these potential negative effects of management measures that only affect U.S. longline vessels, NMFS must develop and implement additional measures that can be also implemented by the large, foreign fleets that fish the North Atlantic Ocean. Fishing tactics and modified gear configurations – technical solutions – that allow longline vessels from all fleets to continue to catch target species effectively are likely to be "exportable" solutions. The situation with TEDs in shrimp fisheries is an excellent model for the development and export of technical bycatch reduction measures. Since the development of TEDs and their required use in domestic shrimp fisheries, NMFS has transferred TED technology to other shrimping nations in the Atlantic and around the world.

8.1. Reductions in the Mortality of Pelagic Juvenile Turtles in the Atlantic Basin that are Required to Recover the Species

Analyses of sea turtle populations in the Atlantic Ocean, NMFS' SEFSC concluded that an increase in pelagic juvenile survival of 10%, throughout the Atlantic Basin, would be necessary to move population trajectories from approximately stable to increasing or from declining to approximately stable. To achieve a 10% increase in annual survival, these analyses concluded that annual mortalities must be decreased correspondingly (for more detailed information on derivation of this value refer to the bar graphs in the NMFS SEFSC (2001) document in Part III, Chapter 6 , Figures 4 and 16, that graphically illustrate the modeling results). Under the most optimistic scenario (that does not consider future effects of TED reg changes), the population is projected to decline or remain stable when the juvenile survival is not increased above the base case that assumes a stable population distribution.

Annual mortality, however, can be considered to have two components: natural mortality, which cannot be changed, and anthropogenic mortality, which can be affected by management actions. The SEFSC models can be used to determine the total pelagic juvenile annual mortality rates, but the proportion of natural vs. anthropogenic mortality in the pelagic stage has not been studied. In the coastal environment, however, the SEFSC report has estimated the total annual mortality affecting benthic stage loggerheads is reduced 30% by the use of TEDs in the shrimp fishery. Since shrimping is the single largest source of anthropogenic mortality in the coastal environment, it appears that a reasonable estimate of the proportion of natural to anthropogenic mortality for benthic stage turtles would be 70:30.

As far as the level of impact of longline fishing, Atlantic ocean-basin wide, on pelagic loggerheads, it is similar to the shrimp scenario in that longline fishing is probably the single largest source of mortality impacting this life stage. Because it is on a similar order of magnitude with the level of impact of coastal shrimp trawling on benthic stages, based on the qualitative comparison that each is the largest industrial fishery in terms of effort in the turtles' pelagic and benthic habitats, respectively, and each is the largest source of anthropogenic turtle captures in the pelagic and benthic environments, 30% is a reasonable estimate in both cases. Using this estimate, the levels of decrease in anthropogenic, pelagic mortality that must be achieved to increase total pelagic survival by 10% were calculated for various model scenarios and are displayed in Table 10.

Th data in Table 10 are based on growth models 3 and 4 as models 1 and 2 were not considered appropriate. Growth models 3 and 4 are based on a new growth curve for benthic loggerheads that better represents the overall loggerhead growth rates for the southeast U.S. (a combination of both the southern and northern nesting populations) than the growth curves used in other models. Model 3 assumes that animals in the model recruit to the next growth stage at the minimum-size-to-stage (more rapid growth). Model 4 assumes that animals in the model recruit to the next growth stage at the average-size-to-stage (less rapid growth). Both models incorporate the best new information. Model 4 may be more representative of the northern nesting population which likely has slower individual growth rates than the southern population. Within these models, pelagic juvenile survival was calculated, assuming a stable population distribution as the base case.

Models 1 and 2 used the annual stage survival rates from Frazer (1987) with assumptions of minimum size to stage and average size to stage, respectively. When the pelagic immature survival rate was solved for in Model 2, it produced an impossible result. NMFS SEFSC (2001) did not carry forward any further analysis of Model 2 in its assessment of the impact of pelagic longline fishery on loggerhead sea turtles. For model 1, the growth curve on which it is based had a relatively poor fit with the observed size structure of stranded sea turtles and also did not match well with other published growth curves for loggerheads. Therefore, models 3 and 4 are the best choice for consideration of magnitude of basinwide change in anthropogenic mortality needed to effect an overall change in population trajectory.

Table 10: Change in Anthropogenic Mortality of Pelagic Juvenile Loggerheads Required to Increase their Survival by 10%

	Pelagic Survival Increase from 0% to +10%	Pelagic Survival Increase from -10% to 0%
Model 3, lambda = 0.97*	-52%	-45%
Model 4, lambda = 0.97	-68%	-56%

* Survival rates for the various model scenarios extracted from Snover (pers. comm.). Lambda is the population growth rate per unit of time; when a population's lambda is 0.97, it is declining by about 3.0% per unit of time.

The main point of this discussion is that while the 10% reduction is a basin wide target, the models illustrate that a reduction in mortality of the life stage most affected by the U.S. longline fishery, the pelagic juvenile stage, must be achieved to reach recovery goals. The selection of an appropriate target specific to the longline fishery in isolation could not be quantified by the NMFS SEFSC (2001). The selection of management actions based on this target and ESA guidance is described in the next section

8.1.2. Selection of Management Targets for the RPA to Reduce the Bycatch of Sea Turtles

NMFS has analyzed observer data associated with the pelagic longline fisheries prosecuted under the HMS FMP to identify patterns that could be changed to avoid the adverse effects that are likely to jeopardize the continued existence of loggerhead and leatherback turtles through the continued operation of the pelagic longline fishery. Management actions should first try to eliminate or reduce the likelihood of interactions between the fishery and sea turtles. For those interactions that cannot be avoided, management actions should reduce the likelihood of sea turtles being injured or killed during or as a result of the interaction. These reductions must be made so that this fishery is no longer appreciably reducing the likelihood of survival and recovery of loggerhead and leatherback sea turtles. The best available scientific information shows that a 55% reduction in anthropogenic mortality of pelagic juvenile loggerheads is necessary to remove the appreciable effect of this fishery on sustainability and recovery of Atlantic loggerheads, taking into account reductions already being made on the other major source of mortality to loggerheads that impacts benthic life stages, the shrimp fishery. The reduction in anthropogenic mortality needed for leatherbacks could not be quantified.

8.2 Specific Elements of the Reasonable and Prudent Alternative

To comply with its obligation to remove jeopardy, NMFS must take action to reduce the impacts of the U.S. Atlantic pelagic longline fishery on loggerhead and leatherback turtles. As previously discussed, the ESA requires that any RPA must remove the jeopardy posed to leatherback and loggerhead sea turtles by the operation of the U.S. Atlantic pelagic longline fleet. Alternatives that ensure that the proposed pelagic longline fisheries prosecuted under the Atlantic HMS FMP are not likely to jeopardize the continued existence of listed species might not ensure that these species will recover in the wild and may not prevent other human activities from causing their ultimate extinction. The RPA is designed to reduce the effects of the pelagic longline fisheries, associated with the HMS FMP only, to such a degree that the effects are not likely to appreciably reduce these turtles' likelihood of surviving and recovering in the wild. What follows is a single RPA, consisting of several sub-elements, that must be implemented in its entirety to avoid jeopardizing listed species.

8.2.1. Closure of the NED Area to U.S. Pelagic Longline Fishing

NMFS must commence rulemaking immediately upon issuance of this opinion to promulgate regulations that close the entire NED area to fishing with pelagic longline gear for U.S. vessels. These regulations must become effective no later than July 15, 2001.

The largest number of interactions between the fishery and sea turtles occur in the Northeast Distant and Northeast Coastal geographical areas. This first element of the alternative eliminates potential interactions between the fishery and sea turtles by closing the area with the greatest impacts, the Northeast Distant geographical area to vessels using pelagic longline gear. Based on estimates from 1999 observer data, this closure would reduce the number of loggerhead and leatherback turtles captured in the fishery by 51 % and 49%, respectively, each year (NMFS SEFSC, 2001; Yeung *et al.*, 2000). Based on logbook data from 1997-1999, this closure would reduce the number of loggerhead and leatherback turtles captured in this fishery by 76% and 65%, respectively, assuming no redistribution of the fishing effort displaced out of the NED. If that fishing effort redistributes randomly across the remaining open areas, the number of loggerhead turtles captured by the fishery would be reduced by 75%; the number of leatherback turtles captured by the fishery would be reduced by 63% based on logbook data. Even assuming that all of the fishing effort that occurred in the NED area shifts into the area with one of the third highest bycatch rates, the Northeast Coastal area, the number of takes per year would still be reduced by 67 % for loggerheads and 58% for leatherbacks, based on the logbook data (K. Brewster-Geisz, pers. comm.). The reduction in takes in the nED, in conjunction with the expected reduction in takes resulting from the RPAs addressing gear modifications, approaches the estimated levels of reduction needed throughout the basin, and thus work even when applied to the HMS fisheries alone. This approaches the levels needed throughout the basin and, therefore, would be expected to work when applied to the HMS fisheries alone. In other words, if you use Table 10 as the basis for change in anthropogenic mortality of pelagic juvenile loggerheads required to increase their survival by 10%, the level identified by the NMFS SEFSC (2001) analysis as needed to change the population trajectory, the average of the 2 models is 55%. However, as noted above m, the relationship is not a linear one. Therefore, as the jeopardy conclusion was made on continued operation of this fishery over 25 years, decreasing mortality in this fishery annually by that amount would mean that there was no longer an appreciable reduction in survival and recovery of loggerhead sea turtles from this action in the long term. Smaller time area closures are not sufficient in the long term because of annual variation in distribution of both turtles and fishing operations. As gear developments or dynamic management alternatives become available, the necessity for a large closure could change.

Subsequent elements of the following reasonable and prudent alternative supplement this closure by reducing the catch rate and the number of sea turtles that are injured or killed during or as a result of interactions with the proposed HMS fisheries. In combination, this reasonable and prudent alternative should reduce the number of loggerhead and leatherback turtles captured and killed in this fishery to levels that would decrease the contribution of these fisheries to reductions in the likelihood that these sea turtles will survive and recover in the wild

8.2.2. Gear Modifications outside the NED Area

8.2.2.1. Restrictions on hook attachment relative to floatlines on pelagic longline gear

NMFS must commence rulemaking immediately upon issuance of this opinion to promulgate final regulations in the Atlantic pelagic longline fleet that prohibit the setting of gangions adjacent to floatlines. These regulations must be published no later than July 15, 2001, with a delayed effective date of August 1, 2001. Specifically, gangions may not be attached next to floatlines nor to the mainline except at a distance from the attachment point of the floatline to the mainline, along the mainline, of twice the length of the average gangion length in the set. The primary purpose of this measure is to decrease the potential for turtles to become hooked.

Hooks that are beneath or adjacent to floatlines have a much higher sea turtle catch rate than hooks one or more positions away from the floatline (Kleiber 2001, NMFS SWFSC, unpubl. report). In observer data from the Hawaii fleet, hooks nearest the floatline caught 45% of all loggerheads, but only represented 19% of the hooks fished on sets that caught loggerheads. Hooks nearest the floatline caught 49% of all leatherbacks, but only represented 17% of the hooks fished on sets that caught leatherbacks. Eliminating hooks in this position could, theoretically, reduce takes of leatherbacks and loggerheads by as much as 49% and 45%, respectively. Such a result is unlikely, however, as turtles might still be caught on the hooks set farther from the floatline. The hook nearest the floatline is 2 to 2.4 times more likely to catch sea turtles than the hook one position from the floatline. That hook, in turn, is 5.7 to 7 times more likely to catch sea turtles than the hooks two or more positions from the floatline. If we assume that fishermen keep the number of hooks in a set constant after removing the hook adjacent to the floatline (*i.e.* effort remains constant) and if the gear is configured so that the shift in effort is into more hooks one position from the floatline, which have a higher turtle catch rate, the catch efficiency of those hooks is still half or less of the hooks adjacent to the floatline. Therefore, NMFS believes it is reasonable to expect that the effect of prohibiting gangions adjacent to floatlines would be a reduction in turtle captures by around 20%. The 45% of loggerheads and 49% of leatherbacks that were formerly captured on the hook adjacent to the floatline may still be available for capture on nearby hooks, but those hooks are less than half as efficient, so half of those turtles would still be reasonably expected to escape, yielding a mathematical capture reduction of 22% for loggerheads and 24% for leatherbacks.

8.2.2.2. Restriction on gangion length in shallow pelagic longline sets

NMFS must commence rulemaking immediately upon issuance of this opinion to promulgate final regulations in the Atlantic pelagic longline fleet that require that, in shallow longline sets, the length of the gangion be greater than the length of the floatline. This must be published no later than July 15, 2001, with a delayed effective date of August 1, 2001. The intent of this requirement is to ensure that hooked turtles have sufficient slack line to be able to reach the surface and avoid drowning. Specifically, for longline sets in which the combined length of the floatline plus the gangion is 100 meters or less, the length of the gangion must be at least 110% the length of the floatline. The purpose of this measure is to prevent injury and mortality to turtles that become hooked No quantitative estimate of this measure can be made a this time.

8.2.2.3. Requirement to use corrodible hooks and crimps

By August 1, 2001, NMFS must identify criteria for, and assess the commercial availability of, corrodible hooks and crimps that are the most effective at reducing post-hooking injury. NMFS believes it is likely that some currently commercially-available gear will have desirable corrosion characteristics for both effective fishing and eventual dissolution and expulsion by hooked turtles. By December 31, 2001, NMFS must promulgate final regulations that require participants in pelagic longline fisheries in the Atlantic to use only corrodible hooks and crimps determined to be effective at reducing impacts to turtles. If no commercial hooks or crimps are identified that meet the criteria, then NMFS must begin development of such hooks and crimps and implement regulations to require their use no later than March 1, 2002. This measure should substantially improve the survival of loggerhead and leatherback sea turtles that are hooked, when external hooks cannot be removed or when hooks are deeply taken and no attempts to remove the hook can be made.

8.2.3. Implementation of Additional Gear Modifications or Fishing Practices and Re-opening of the NED Area

Recognizing that the U.S. domestic longline fisheries are a small segment of the total amount of longline fishing that occurs in the Atlantic Ocean, NMFS believes that research to develop or modify gear technologies and fishing strategies to reduce capture rates of sea turtles throughout the Atlantic Ocean would improve the status of sea turtles. Developing gear technologies or fishing strategies that are capable of significantly reducing the likelihood of capturing turtles or dramatically reducing the immediate or delayed mortality rates of captured turtles are needed to minimize the effects of domestic and international longline fishing vessels. In order to increase the likelihood of survival and recovery of sea turtle populations in the Atlantic Ocean, NMFS shall work with federal and non-federal researchers to develop innovative strategies and measures to diminish the adverse effects of commercial fishing operations on sea turtle species. By developing new technologies, NMFS will be in a better position to develop and cultivate open and collaborative dialogue and action within the international fishing community to improve the status of listed sea turtles throughout the Atlantic Ocean. Improving the status of listed sea turtles in the Atlantic Ocean would reduce the effect of the U.S. HMS fisheries on these species.

In order to achieve this goal, NMFS shall conduct experiments as necessary and appropriate to modify existing gear to (1) reduce the likelihood of interactions between fishing gear and sea turtles and (2) dramatically reduce immediate and delayed mortality rates of turtles captured in the fisheries (e.g., visual or acoustic cues, dyed bait, hook type). Research funded or implemented by NMFS must receive a research and enhancement permit pursuant to section 10(a)(1)(a) of the ESA. NMFS shall conduct section 7 analyses on the issuance of any such permits. The goal of any research shall be to use robust experimental assessments to develop technologies or methods that would achieve the goals outlined in the preceding paragraph and remain economically and technically feasible for fishermen to implement.

Upon completion of the aforementioned research and its final analysis, NMFS Highly Migratory Species Division must promptly conduct a rulemaking to require the adoption of complementary bycatch reduction measures that, in concert with the bycatch reduction measures required by this Opinion and the June 30, 2000, Opinion, have been shown to achieve overall sea turtle mortality reductions of at least 55%. This rulemaking must be completed before pelagic longline vessels are allowed to fish within the NED area, other than as participants in permitted scientific research.

9.0 Incidental Take Statement

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

Section 7(b)(4)(c) of the ESA specifies that in order to provide an incidental take statement for an endangered or threatened species of marine mammal, the taking must be authorized under section 101(a)(5) of the MMPA. Since no incidental take of listed marine mammals is expected or has been authorized under section 101(a)(5) of the MMPA, no statement on incidental take of endangered whales is provided and no take is authorized. Nevertheless, NMFS Office of Sustainable Fisheries (F/SF) must immediately (within 24 hours, if communication is possible) notify the NMFS Office of Protected Resources (F/PR) should a take of an endangered whale occur.

9.1 Amount or extent of take

NMFS believes that the following levels of incidental take may be expected to occur as a result of the proposed action and the implementation of the RPA. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. F/SF must immediately provide an explanation of the causes of the taking and review with F/PR the need for possible modification of the reasonable and prudent measures.

As noted previously, the number of green and Kemp's ridley that Scott and Brown (1997) and Johnson *et al.* (1999) estimated to have been taken in the fishery probably resulted from misidentifications (Hoey 1998, Witzell 1999). It also is likely that the hawksbill reported in Yeung (1999) was misidentified (Witzell, pers. comm.). In subsequent years, sampling must confirm which species are caught by the fishery (see Terms and Conditions 4(a)) and be addressed in the analysis.

9.1.1. Pelagic Longline Fishery for Swordfish, Tuna, and Shark

Sea turtles that may be taken as the result of the experimental fishery or supplemental research activities to develop bycatch reduction techniques in U.S. waters or aboard U.S. fishing vessels are not considered in this incidental take statement. For sea turtle research under U.S. jurisdiction (and including the high seas) that would require an ESA Section 10(a)(1)(a) permit, a separate incidental take statement specifically developed for that permit would govern. For overseas activities in waters of foreign nations, the requirements of the ESA would not apply.

The implementation of the closed areas at DeSoto Canyon, Florida East Coast, and the Charleston Bump were previously estimated, based on logbook data, to increase sea turtle takes by about 7% because of effort redistribution. Under the RPA, however, effort redistribution into the NED Area, with its high bycatch rates, is prevented by the closure in the RPA. If the effort that is displaced out of the HMS closed areas randomly redistributes across all other available fishing areas, the increase in sea turtle bycatch is reduced to 5% (Sutter, pers. comm., 2001). The estimates of Yeung *et al.* (2000) for 1999, increased by 5%, would translate to 503 loggerheads and 546 leatherbacks captured outside the NED Area. The RPA also contains an element that is expected to reduce sea turtle bycatch by around 20% (see RPA 3 for further discussion). The specified annual anticipated take is based upon these closures as well as the anticipated reduction from the RPA gear modifications. In this Opinion, the impacts from post hooking mortality were assessed as a proportion of the total estimated take ranging from 27 - 42%, depending on the location of the hook. Pelagic longline vessels will be monitored through observers at coverage levels that should produce relatively robust sea turtle bycatch estimates. The anticipated incidental take levels for the pelagic longline fishery are:

Leatherback sea turtles –	438 turtles *estimated* captured per calendar year,
Loggerhead sea turtles –	402 turtles *estimated* captured per calendar year
Green, Hawksbill, and Kemp's ridley turtles (combined) –	35 turtles *estimated* captured per calendar year

9.1.2 Remaining HMS Fisheries

The recent HMS management measures and the RPA affect only the pelagic longline portion of the HMS fisheries, so the levels of incidental take that were anticipated in previous Opinions on HMS fisheries are not expected to change as the result of management measures. Therefore, anticipated levels of incidental take for other HMS fisheries generally remain unaltered (as listed below). New information from the shark drift gillnet observer program in 2001 has been incorporated in establishing the incidental take levels for that fishery. In addition, according to the most recent information available, a shark gillnet fishery may be forming off Alabama. Levels of incidental take for shark gillnet gear anticipated under this Opinion were formed without consideration of this additional effort. If additional effort takes place in this fishery under the purview of NMFS (*i.e.,* fishermen who hold a limited access permit for sharks), it must be monitored, and appropriate incidental take levels incorporated into a reinitiated opinion.

9.1.2.1. *Southeast U.S. Shark Drift Gillnet Fishery*

Based on limited observer data available, NMFS anticipates that continued operation of this fishery will result in the capture of twenty (20) loggerhead sea turtles, four (4) leatherbacks, of which no more than two (2) are lethal, two (2) Kemp's ridley sea turtles, two (2) green sea turtles, and two (2) hawksbill sea turtles annually. These limits represent the number of total estimated takes (that is, after extrapolating across total effort levels) anticipated for this fishery.

9.1.2.2. *Bottom Longline Fishery for Sharks*

Based on the limited observer data available, NMFS anticipates that continued operation of this fishery will result in the capture of twelve (12) loggerhead sea turtles, two (2) leatherback, two (2) Kemp's ridley, two (2) green, and two (2) hawksbill sea turtles annually. Because total effort levels in this fishery are unavailable, these limits represent the number of total observed takes anticipated (*i.e.*, no extrapolation across total effort levels). If total effort levels are made available such that total estimates of take are possible, this level of incidental take will be revised accordingly.

9.1.2.3. *Other HMS Fisheries*

Since potential for take in other HMS fisheries is low, NMFS anticipates that continued operation of additional HMS fisheries (*i.e.,* tuna purse seine, harpoon/hand gear fisheries, hook-and-line, *etc.*) will result in documented takes of no more than three (3) sea turtles, of any species, in combination, per calendar year.

9.2 Reasonable and Prudent Measures

Section 7(b)(4) of the ESA requires that when an agency action is found to comply with section 7(a)(2) of the ESA and the proposed action may incidentally take individuals of listed species, NMFS will issue a statement specifying the impact of any incidental taking. It also states that reasonable and prudent measures necessary to minimize impacts, and terms and conditions to implement those measures be provided and must be followed to minimize those impacts. Only incidental taking by the federal agency or applicant that complies with the specified terms and conditions is authorized.

The reasonable and prudent measures and terms and conditions are specified as required by 50CFR § 402.14 (i)(1)(ii) and (iv) to document the incidental take by HMS fisheries and to minimize the impact of that take on sea turtles. These measures and terms and conditions are non-discretionary, and must be implemented by NMFS in order for the protection of section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this incidental take statement. If NMFS fails to adhere to the terms and conditions of the incidental take statement through enforceable terms, and/or fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of the incidental take, the F/SF must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement [50 CFR 402.14(i)(3)].

NMFS believes the following reasonable and prudent measures are necessary and appropriate to monitor and minimize take of listed species considered in this Opinion:

(a) NMFS must implement educational programs for fishers which are aimed at reducing the potential for serious injury or mortality of hooked turtles.

2. NMFS must ensure that monitoring of HMS fisheries will (1) detect adverse effects resulting from HMS fisheries, (2) assess the actual level of incidental take in comparison with the anticipated incidental take documented in this opinion, (3) detect when the level of anticipated incidental take is exceeded, (4) collect improved data from each protected species encountered, and (5) determine the effectiveness of reasonable and prudent measures and their implementing terms and conditions.

9.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, NMFS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

9.3.1. Terms and Conditions for the Pelagic Longline Fishery

(a) *Observer coverage.* As in previous consultations, 5% coverage in the pelagic longline fishery is still required. The observer coverage must be distributed according to a stratified random sampling scheme that will adequately sample the fishery to determine levels of protected species takes. At a minimum, the regime must ensure that sampling occurs annually at a statistically reliable level of coverage within all statistical areas fished. If necessary to comply with agreements with ICCAT or to achieve adequate sampling for either HMS or protected species, this scheme may be separate from or supplemental to the HMS sampling program.

(b) *Reporting Lethal Take.* NMFS' HMS Management Division must require vessel captains to report any turtles that are dead when they are captured or that die during capture to SEFSC Observer program within 48 hours, of returning to port.

(c) *Mid-Atlantic Bight Analysis.* In the draft FMP, NMFS committed to analyzing the effects (on marine mammal bycatch only), of limiting the length of pelagic longline gear in the Mid-Atlantic Bight area to 24 nm. NMFS must also analyze effects of this restriction on resulting bycatch of sea turtles. This analysis must be completed by December 31, 2001.

(d) *Sea Turtle Injury Workshop.* NMFS must conduct a workshop to address the issue of sea turtle injury and post-hooking mortality which result from interactions with longline gear.

9.3.2. Terms and Conditions for the SE Shark Drift Gillnet Fishery

(a) *VMS vs. Observer Coverage.* VMS may be used as an alternative to the previous 100% observer coverage requirement; however, VMS cannot be used to replace observer monitoring for any strike-netting effort which may take place within the Southeast right whale calving ground closure area; and observer coverage necessary to monitor incidental take levels for sea turtles must be maintained year-round. NMFS F/SF should investigate new VMS technologies and incorporate advances, such as video technology, if practicable. Eventually, good video technology could possibly eliminate or at least greatly reduce the need for observers.

(b) *Actions upon Sighting of a Whale.* With respect to the Southeast shark gillnet/strikenet fishery, the April 23, 1997, Opinion required that regulations be promulgated to prohibit setting gear in this fishery within 3 nm of a listed whale sighting and, if a whale is sighted within that range, require nets or lines to be hauled back immediately. Both the observer and the vessel operator will be responsible for sightings of whales. If any listed whale is taken in gear, the vessel operator must cease all fishing activities immediately and contact NMFS (Southeast Regional Office). This requirement was partially fulfilled via the May 1999 rule implementing the HMS FMP. However, current ALWTRP and HMS regulations do not specify the party responsible for sighting whales, nor do they clearly indicate that the vessel operator must contact NMFS and cease fishing in the event of any take of listed whales. NMFS F/PR must ensure that the ALWTRP is amended accordingly, and F/SF must adopt this provision as a requirement under the FMP, the next time these rules are revised.

(c) *Fisherman Education.* NMFS must ensure the outreach coordinators described in 9.3.4(c) work to ensure all shark gillnet fishermen are educated on gear handling techniques and protocols to deal with entanglements and protected species in general, to reduce the potential for serious injury or mortality should an entanglement occur. Recommendations from the ALWTRP should be followed in the development of these programs. Full implementation of this alternative will help avoid jeopardy because, although it may not prevent an entanglement, the potential for serious injury or mortality would be significantly reduced.

(d) *Accurate Effort Reporting*. NMFS must provide F/PR, Northeast and Southeast Regions with accurate effort data for all gillnet effort (regardless of type) directed at sharks. This is necessary to better determine actual effort levels in the gillnet components (*e.g.*, strike and driftnet) of the fishery in order to better understand how much gillnet effort occurs in this area, in general (for improved sea turtle take estimates), to better understand what effort levels may still be occurring in the area during right whale season, and to facilitate monitoring of compliance with requirements under the ALWTRP and the FMP regarding mandatory 100% observer coverage of the fishery (or the VMS alternative outlined above) during right whale season. This must be provided annually.

(e) *Observer Coverage.* Observer coverage is required and shall be sufficient to produce statistically reliable results to evaluate the impact of the fishery on sea turtles, including appropriate seasonal coverage. Observers will collect information to: (i) facilitate the understanding of the dynamics of the interaction with sea turtles; (ii) evaluate possible relationships between gear type/fishing strategies and turtle interactions; and (iii) better understand the population structure, status, and life history of turtles incidentally taken by the fishery. Quarterly and annual reports summarizing protected species bycatch data collected for this fishery shall be prepared and disseminated in a timely fashion to the Northeast and Southeast Regions and F/PR. Annual reports shall include extrapolations of total take for each species across the entire fishery (see 4 (g) below for details).

(f) *Jellyfish Reporting*. Observers must report any turtle take and/or high densities of jellyfish within 24 hours to the SEFSC Observer Program Coordinator, who in turn must provide this information to the Southeast Region, F/PR and F/SF.

(g) *Net Checking*. It is customary in the shark fishery for fishermen to check the length of the net every 0.5 -2 hrs with a spotlight to check the net and catch. Fishermen must be instructed to look for sea turtles and marine mammals during those checks and remove any protected species from the net immediately. Continuing education of fishermen to ensure implementation of this condition will be accomplished by the outreach coordinators identified in term and condition 4(c) below.

9.3.3. Terms and Conditions for the Bottom Longline Fishery for Sharks

(a) *Observer Coverage*. NMFS must continue to implement an observer program, or ensure that financial support is provided to fund an external program such as the previous MARFIN-funded study, to monitor incidental takes of listed species in the bottom longline fishery for sharks.

(b) *Accurate Effort Estimates.* Within 12 months of the signature date of this biological opinion, NMFS must implement a mechanism for estimating total effort levels in this fishery in order to provide accurate estimates of sea turtle bycatch. Quarterly and annual reports summarizing protected species bycatch data collected for this fishery shall be prepared and disseminated in a timely fashion to the Northeast and Southeast Regions and F/PR. Annual reports shall include estimates of total take for each species across the entire fishery (see 4 (f) below for details).

9.3.4. Terms and Conditions Applicable to All HMS Fisheries

(a) *Observer data collection.* NMFS observers must record information on the condition of sea turtles and marine mammals when released as well as describe in detail the interaction with the gear (*e.g.,* for longline interactions: entangled (where, and to what extent), ingested hook, internal or external hook). Photographs must be taken to confirm species identity and release condition. Collection of these data are critical to accurately monitor incidental take levels and assess mortality levels of sea turtles in this fishery. NMFS must ensure that when protected species are taken, dealing with each animal (*e.g.,* resuscitating, tagging/scanning for tags, collecting a full suite of samples [per instruction of the SEFSC sea turtle coordinator], and releasing, *etc.*) must be the observer's sole priority.

(b) *Observer collection of tissues for genetic sampling.* Within 3 months from the signature date of this Opinion, NMFS must ensure that observers associated with the HMS fisheries collect tissue samples from sea turtles caught in the fisheries and ensure that these tissue samples are analyzed to determine the genetic identity of individual turtles caught in the fishery. To fulfill this requirement, NMFS must ensure that observers associated with the HMS fisheries are equipped with the tools, supplies, training, and instructions to collect and store tissue samples and that the NEFSC and SEFSC are funded to analyze those samples.

(c) *Fisherman Outreach.* The April 1997, May 1999, and June 2000 Opinions required outreach via fisherman workshops. A number of such workshops were held, but attendance was low and they did not seem to be an effective outreach tool for this particular fishery. Therefore, in lieu of these fisherman workshops, NMFS must finance, and work with the Northeast and Southeast Regions and F/PR in developing and supporting, an outreach program to be implemented by a Protected Species Outreach Coordinator. Outreach efforts must include dockside fisher education patterned after the Northeast Region's ALWTRP outreach program, including production and distribution of outreach materials, staff assistance/expertise as needed in development of outreach materials, and education and encouragement of fishermen to use the suite of take reducing parameters outlined in the reasonable and prudent alternatives above, as well as any new ideas/developments which appear worthy of implementation. Development of an approach must be conducted, in consultation with F/PR and the Northeast and Southeast Regions, by December 31, 2001.

(d) *Fisherman collection of tissues for genetic sampling.* To supplement the effectiveness of the observer tissue collection effort, NMFS must create a training mechanism whereby vessel captains in HMS fisheries may be trained and receive authorization to collect tissue samples from incidentally captured sea turtles for use in genetic analyses. Within 3 months from the signature date of this Opinion, NMFS must develop a training program and publish a notice in the *Federal Register,* advising fishermen of the requirements of the training program and how to receive training. Vessel captains who successfully complete the training program will be provided with the necessary tools and supplies to collect samples and will receive a written authorization to collect samples, along with such other restrictions and requirements as may be deemed necessary. Tissue collection under the conditions of the written authorization (*i.e.*, NMFS certification of completion of the training program) are authorized takes, as part of the incidental take statement of this Opinion.

(e) *Sea Turtle Resuscitation*. NMFS must continue to distribute appropriate sea turtle resuscitation and handling techniques found in 50 CFR part 223.206(d)(1), as follows:

"Resuscitation must be attempted on sea turtles that are comatose or inactive but not dead by placing the turtle on its breastplate (plastron) and elevating its hindquarters several inches for a period of 1 hour up to 24 hours. The amount of the elevation depends on the size of the turtle; greater elevations are needed for larger turtles. Sea turtles being resuscitated must be shaded and kept wet or moist. Those that revive and become active must be released over the stern of the boat only when trawls are not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels."

By September 15, 2001, NMFS must issue a regulation requiring that all vessels permitted for HMS fisheries post the sea turtle guidelines for safe handling in longline interactions inside the wheelhouse (to ensure that the owner passes it on to the captains and that it can be referred to as needed). Continuing education of fishermen to ensure full implementation of this condition will be accomplished by the outreach coordinators identified in term and condition 4(c) above.

(f) *Reporting.* A report must be submitted on a calendar quarter basis to PR, the Southeast Region, and SF. The report must provide the following information on each sea turtle take: species, date and location of interaction, target catch, tag identification (if appropriate) whether photographs or genetic samples were taken. NMFS must also provide an annual report of sea turtle take estimates based on observed takes. The report must provide species specific take estimates as well as an overall estimate of total sea turtle take. This report must also include data on the condition of each individual sea turtle, in order to obtain better data on the level of impact that this fishery may be having with respect to post-release survival. These data should include information on where the animal was hooked or otherwise entangled, depths of imbedded hooks, and actual written comments by the observers. In this regard, observer data coordinators must consult with F/PR and the Northeast and Southeast Regions to ensure data collected is sufficient in detail to accomplish this goal. The report must be forwarded to the Chief of the Endangered Species Division, Office of Protected Resources, Silver Spring, Maryland, and copied to the Chiefs of the Northeast and Southeast Region Protected Resources Divisions.

10.0 Conservation Recommendations

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities 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.

(1) *In-water Abundance Studies*. In order to better understand sea turtle populations and the impacts of incidental take in HMS fisheries, NMFS should support in-water abundance estimates of sea turtles to achieve more accurate status assessments for these species and improve our ability to monitor them.

(2) *Population Viability Analyses*. Once reasonable in-water estimates are obtained, NMFS should also support population viability analyses or other risk analyses of the sea turtle populations

affected by HMS fisheries. This will help improve the accuracy of future assessments of the effects of different levels of take on sea turtle populations.

(3) *International Fisherman Education*. NMFS should ensure that the *Sea Turtle Handling Guidelines* are translated into several languages (*e.g.*, Portuguese, Spanish, Italian, Greek), printed, and distributed throughout the longline fisheries operating in the North Atlantic and Mediterranean in order to enhance survival of all turtles/subpopulations hooked, even those taken by foreign countries (as these fisheries all impact U.S. nesting populations).

(4) *International Negotiations*. NMFS should focus efforts on the broader impacts that occur to loggerhead and leatherback populations throughout the Atlantic by using its available legal authorities (*e.g.*, Sec. 202(h) of the MSFCMA and Sec. 609(a) of Public Law 101-162) to pursue bilateral or multilateral agreements for the protection and conservation of sea turtles with other nations whose commercial longline fleets may affect sea turtles. NMFS, in partnership with the U.S. Department of State, should make every effort to use existing bilateral and multilateral mechanisms, to which the U.S. is a party, to focus the actions of those mechanisms on the problem of sea turtle-longline bycatch. Such existing multi-lateral mechanisms may include ICCAT, the U.N. Food and Agriculture Organization Committee on Fisheries (FAO/COFI), the nascent Inter-American Convention for the Protection and Conservation of Sea Turtles, the Asia Pacific Fisheries Commission, and the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific. Potential additional mechanisms include the Indian Ocean Regional MOU for the Conservation and Management of Sea Turtles. NMFS has already requested (in September 2000) and conducted (in February 2001) consultations with the Department of State under section 202(h) of the MSA to develop an international sea turtle-longline bycatch reduction strategy. In addition, NMFS should pursue similar avenues to promote international sea turtle conservation in general, but with particular emphasis on protecting leatherback sea turtles in the Guianas on their nesting beaches and from incidental capture in coastal gillnet and trawl fisheries.

NMFS should support a workshop to bring together international longline fishery experts (industry or governmental), from those nations with major longline fishing effort. The goal of such a workshop would be to assemble information on international rates of sea turtle interactions, exchange ideas on bycatch reduction measures, stimulate international research on sea turtle-longline interactions, and promote the development of binding international mechanisms to address sea turtle-longline interactions. NMFS and its governmental partners should subsequently make every effort to place the issue of sea turtle-longline interactions on the agenda of, and hold negotiations/discussions at, a major international body such as FAO/COFI or ICCAT. As the experimental fisheries yield results on the effectiveness of various bycatch reduction techniques, NMFS must share those results with other longline fishing nations and encourage the adoption of those measures that prove effective. If adoption of measures by foreign fleets to a degree that would assure the survival of loggerhead and leatherback turtles in the North Atlantic is deemed to be unlikely with existing international mechanisms, NMFS should seek additional legislative authority to address the threat of international longline fisheries to sea turtles, similar to section 609(b) of Public Law 101-162.

(5) *Scientific Experiments.* NMFS should undertake, in consultation and cooperation with the domestic pelagic longline fleet, a cooperative research program to develop and evaluate the efficacy of new technologies and changes in fishing practices. This program should commence by August 1, 2001 and should be completed within three fishing seasons (*i.e.*, by January 2004).

Fishing Vessel-Based Research in the NED Area

The primary aspect of the scientific experiment should be the utilization of domestic fishing vessels as cooperative research platforms in the NED statistical sampling area. Participating U.S. longline vessels that fish in the NED must carry observers, and they must fish their gear in a specified, pre-determined manner designed to test one or more variables affecting sea turtle bycatch. Vessels that refuse to carry observers, that are not equipped to safely carry observers, or that refuse to fish their gear according to the experiment, should not be allowed to participate in the scientific experiment. The NED Area is the only area used by the U.S. fleet that is likely to yield the high level of turtle interactions required to test the effectiveness of bycatch reduction measures.

Research Plan for the NED Scientific experiment

Prior to July 1, 2001, NMFS should develop a research plan for the NED scientific experiment. The research plan for the fishery should comply with the following four conditions: (1) the target mortality reduction rate for a measure, or measures taken in combination, is 55% (the mean value for reduction of anthropogenic mortality from Table 10), compared to current standard fishing practices, for loggerheads and leatherbacks; (2) the duration of the experiment is no more than 3 years; (3) all measures tested must be “exportable.” That is, they must be easily described (such as in a regulation), they must be enforceable, they should preserve target species catch to the greatest extent possible, and they must be broadly applicable to fishing in different environments; and (4) the 55% reduction target in sea turtle mortality rates for the North Atlantic Ocean may be achieved by reducing the catch rates of turtles or by improving their post-hooking survival. Bycatch reduction, though, should be the primary emphasis of the experiment. As stated before, successfully quantifying post-hooking survival and changes in it brought about by different treatments is very difficult and expensive. In addition, experimentation with treatable factors that affect mortality may raise ethical problems. For example, withholding an effective treatment (*e.g.,* leaving a turtle entangled when the line could be easily removed) in order to assess the associated mortality would not be acceptable, whereas trying to distinguish the differential survival between animals that are already injured (*e.g.,* deeply hooked vs. lightly hooked) may be acceptable.

Experimental Design and Management

A mechanism should be developed to include the fishing industry in developing the experimental design and in the management and oversight of the experiment. Analyses have been conducted and give guidance on the amount of sampling in the NED that is likely to be necessary to test bycatch reduction measures of varying effectiveness. These analyses, along with the number of participating vessels, will determine the number of parameters that can be tested and should be considered in selecting and prioritizing the measures to be tested.

Interim Analyses

Within 3 months of the completion of each fishing season (*i.e.,* before April 2002, April 2003, and April 2004), NMFS should analyze the results of the previous years' scientific experiment for the effects of all the tested parameters on sea turtle and target species catch rates. It is expected that the research plan would be flexible and may be changed as results come in during the course of the experiment.

Completion of the NED Scientific experiment

If management measures are developed that achieve or exceed the target of 55% bycatch reduction before the end of the 3-year period, the scientific experiment should not be discontinued prematurely. The scientific experiment should be used to continue to develop additional measures that may allow greater sea turtle take reductions, greater flexibility in selecting among take reduction options, and greater preservation or enhancement of target species catch rates.

Supplementary Research
To supplement the NED scientific experiment and maximize its chances for success, NMFS should conduct additional research directed at understanding and reducing sea turtle-longline interactions. NMFS should consider the possibility of using turtles in captivity to conduct preliminary investigations that may focus field research. Captive turtles may be used, for example, to investigate chemical or visual repellents, bait preferences, feeding behaviors, and attraction or aversion to different color light sticks. At-sea research, aboard research vessels or contracted fishing vessels, may be appropriate for conducting research projects focused at sea turtle behavior questions or for preliminary feasibility trials of gear modifications. Finally, NMFS should consider sponsoring or conducting experimental work in foreign longline fishing fleets. This work may also establish the basis for future collaboration on international approaches to reduce sea turtle-longline interactions.

(7) *Effectiveness of MARPOL*. NOAA/NMFS should meet with representatives of the U.S. Coast Guard to determine what benefits, if quantifiable, have accrued since the signing of the MARPOL agreement limiting pollution and dumping at sea; and explore ways with the Coast Guard to make this agreement more effective and to improve compliance through enforcement and outreach.

11. Reinitiation of Consultation

This concludes formal consultation on the continued operation of the Atlantic HMS fisheries, as regulated by the HMS FMP and the Billfish FMP, as amended. 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 taking specified in the incidental take statement is exceeded, (2) 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 (*i.e.*, proposed quota reduction and limited access rules are changed), (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the identified action. If the amount or extent of incidental take is exceeded, NMFS F/SF must immediately request reinitiation of formal consultation.