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 Pelagic Longline Fishery for Highly Migratory Species

Consulting Agency: National Marine Fisheries Service, Southeast Regional Office

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Date Issued: 6/1/04 JUN 1 2004

INTRODUCTION

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 any 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 (NOAA Fisheries) or the U.S. Fish and Wildlife Service (USFWS), depending upon the protected species that may be affected. Formal consultations on most listed marine species are conducted between the action agency and NOAA Fisheries. Consultations are concluded after NOAA Fisheries' issuance of a biological opinion (opinion) that identifies whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify critical habitat. If jeopardy or destruction or adverse modification is found to be likely, the opinion must identify the reasonable and prudent alternatives (RPAs) to the action, if any, that would avoid jeopardizing any listed species and avoid destruction or adverse modification of designated critical habitat. The opinion also includes an incidental take statement (ITS) which specifies the amount or extent of incidental taking that may result from the proposed action. Non-discretionary reasonable and prudent measures (RPMs) to minimize the impact of the incidental taking are included, and conservation recommendations are made. Notably, there are no reasonable and prudent measures associated with critical habitat, only reasonable and prudent alternatives that must avoid destruction or adverse modification.

The present consultation considers the continued authorization of the Atlantic pelagic longline fishery as managed under the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (HMS FMP). NOAA Fisheries has dual responsibilities as both the action agency under the Magnuson-Stevenson Fishery Conservation and Management Act (MSA) (16 U.S.C. *1801et seq*.) and the consulting agency under the ESA. For the purposes of this consultation, the Highly Migratory Species Management Division (HMS Division) of NOAA Fisheries' Office of Sustainable Fisheries (OSF) is considered the action agency, and NOAA Fisheries' Southeast Regional Office (SERO) is the consulting agency. This opinion has been prepared by the SERO Protected Resources Division (SERO-PRD). This document constitutes NOAA Fisheries' opinion on the effects of the U.S. Atlantic pelagic longline fishery (herein referred to as the HMS pelagic longline fishery), on threatened and endangered species and critical habitat, in accordance with section 7 of the ESA. Specifically, this opinion analyzes the effects of proposed regulatory modifications to the HMS FMP that address the impacts of the HMS pelagic longline fishery on endangered green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), and leatherback sea turtles (*Dermochelys coriacea*) and on threatened loggerhead (*Caretta caretta*), and olive ridley sea turtles (*Lepidochelys olivacea*). This opinion also evaluates the likelihood of effects on other marine listed species.

This opinion is based on the following information sources:

- The February 11, 2004, proposed rule to modify regulatory requirements for the HMS pelagic longline fishery to reduce sea turtle bycatch and mortality (69 FR 6621);
- The Draft Supplemental Environmental Impact Statement (DSEIS) associated with the February 11, 2004, proposed rule;
- The April 20, 2004, memorandum from OSF to SERO regarding revised alternatives under consideration for the final rule to modify regulatory requirements for the HMS pelagic longline fishery to reduce sea turtle bycatch and mortality.
- The June 20, 2003, proposed rule to implement north and south Atlantic swordfish recommendations from the 2002 International Commission for the Conservation of Atlantic Tunas (ICCAT) meeting (68 FR 36967);
- The DSEIS associated with the June 20, 2003, proposed rule;
- Sea turtle recovery plans;
- Past and current research and population modeling efforts;
- Observer and logbook data on fishery effort and protected species interactions in the HMS pelagic longline fishery;
- The results of recent experiments to evaluate methods to reduce sea turtle bycatch and mortality in the HMS pelagic longline fishery;
- Other relevant scientific data and reports, consultation with HMS Division staff; and
- Previous opinions for this and other relevant fisheries.

A complete administrative record of this consultation is maintained at SERO.

1.0 CONSULTATION HISTORY

1.1 Previous Consultations

Over the past two decades, NOAA Fisheries has conducted numerous formal and informal ESA section 7 consultations on Atlantic HMS fisheries managed under the HMS FMP and Amendment 1 to the Billfish Fishery Management Plan (Billfish FMP). Earlier consultations are summarized in the June 30, 2000, and June 14, 2001, consultations. The June 30, 2000, and June 14, 2001 consultations and subsequent consultations are discussed below. Collectively, these consultations have comprehensively covered all components of the Atlantic HMS fisheries: the fisheries for tuna, swordfish, sharks, and billfish (recreational only) in the western Atlantic, Caribbean, and Gulf of Mexico, including the pelagic driftnet, drift gillnet, pelagic longline, bottom longline, purse seine, and hand gear (hook and line, handline, and harpoon) fisheries.

The June 30, 2000, opinion on the continued authorization of HMS fisheries considered a December 15, 1999, proposed rule (64 FR 69982) to implement various time-area closures in the HMS pelagic longline fishery. The time-area closures were intended to conserve billfish and undersized swordfish. That opinion concluded that, even with the proposed closures, the HMS pelagic longline fishery was likely to jeopardize the continued existence of loggerhead and leatherback sea turtles. To avoid this jeopardy, the opinion offered two possible RPAs. Regulations implementing the selected RPA closed the Northeast Distant (NED) statistical reporting area to pelagic longline fishing and required HMS pelagic longline vessels to carry dipnets and line-cutters to minimize entanglement and post-release mortality of sea turtle bycatch.

The final rule implementing the proposed time-area closures was published on August 1, 2000, and became effective September 1, 2000 (65 FR 47214). In that final rule, the proposed closure of the western Gulf of Mexico to conserve billfish was replaced with a Gulf-wide prohibition on the use of live bait with pelagic longline gear. Also, a year-round closure of the DeSoto Canyon area in the northeastern Gulf of Mexico was added to further reduce dead discards of small swordfish. Lastly, the final rule also modified the time-area closures proposed for the South Atlantic region, and included a year-round closure of the area south of 31 N. latitude (the "East Florida Coast" closure area) and a February 1 through April 30 closure of the area between 31 N - 34 N latitude (i.e.*,* the "Charleston Bump" closure area).

NOAA Fisheries issued emergency regulations on October 13, 2000, that closed a 55,970 square nautical mile L-shaped portion of the NED area to pelagic longline fishing from October 10, 2000, through April 9, 2001 (65 FR 60889). This closure, as required under the June 30, 2000, opinion's RPA, was intended to reduce the incidental capture of loggerhead and leatherback sea turtles. The emergency regulations also required the use of dipnets and line-cutters to remove entangling fishing gear and reduce post-release mortality of sea turtles captured in the HMS pelagic longline fishery. To prevent a lapse in sea turtle post-release mortality reduction measures, NOAA Fisheries published an interim final rule on March 30, 2001 (66 FR 17370), which continued the requirement to possess and use dipnets and line-cutters for all vessels in the HMS pelagic longline fishery.

NOAA Fisheries conducted a series of public scoping hearings in July and August 2000 to present the findings of the June 30, 2000, opinion and to gather information and insights from affected constituents. During that process, NOAA Fisheries concluded that further analyses of observer data and additional population modeling of loggerhead sea turtles were needed to determine more precisely the impact of the HMS pelagic longline fishery on sea turtles. For that reason, NOAA Fisheries reinitiated consultation on the HMS fisheries on September 7, 2000.

The reinitiated consultation on HMS fisheries was concluded with the issuance of a June 14, 2001, opinion. The opinion represented a comprehensive examination of the effects of all of the fisheries covered under the HMS FMP and the Billfish FMP on sea turtles in the western Atlantic Ocean. The opinion incorporated findings from a January 2001, technical gear workshop in Silver Spring, Maryland, that was attended by scientists, fishermen, environmentalists, and other interested parties. Additionally, the opinion incorporated findings of a February 2001 document: *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* prepared by NOAA Fisheries' Southeast Fisheries Science Center (SEFSC). The opinion concluded that the continued prosecution of the HMS pelagic longline fishery was likely to jeopardize the continued existence of loggerhead and leatherback sea turtles. All other fishery components, including the Atlantic bottom longline and gillnet fisheries for sharks, were found not to jeopardize the continued existence of any ESA-listed species.

The June 14, 2001, opinion specified an RPA for the pelagic longline fishery that would avoid the likelihood of jeopardizing the continued existence of loggerhead and leatherback sea turtles. The RPA included the following elements:

- Closure of the NED area to HMS pelagic longline fishing, effective July 15, 2001;
- A requirement that gangions be placed no closer than twice the average gangion length from the suspending floatlines, effective August 1, 2001;
- A requirement that gangion lengths be 110 percent of the length of the floatline in sets of 100 meters or less in depth, effective August 1, 2001;
- A requirement for the use of corrodible hooks effective August 1, 2001; and
- A requirement for additional gear modification or fishing practices prior to reopening the NED based on a new cooperative research program.

The opinion included a term and condition as part of the ITS that required action by NOAA Fisheries no later than September 15, 2001, to reduce post - release mortality of turtles caught on longline gear. The term and condition required all commercial and recreational HMS-permitted vessels to post inside the wheelhouse guidelines for the safe handling and release of sea turtles following longline interactions.

On July 13, 2001, NOAA Fisheries published an emergency rule to implement several of the opinion requirements (66 FR 36711). Regulations implemented by this emergency rule included a closure of the NED Area to HMS pelagic longline fishing, restrictions regarding gear deployment, and a requirement to post the safe handling procedures inside the wheelhouse. Subsequently, an August 31, 2001, memorandum from NOAA Fisheries' Office of Protected Resources modified the term and condition to post the safe handling procedures inside the wheelhouse so that it applied only to bottom and pelagic longline vessels. Therefore, on September 24, 2001, NOAA Fisheries published an amendment to the emergency rule (66 FR48812) to incorporate this change. These requirements, effective through January 9, 2002, were extended to July 8, 2002 (66 FR 64378, December 13, 2001). On January 14, 2002, NOAA Fisheries published an amendment to the emergency rule extension clarifying the effective dates (67 FR 1688).

On July 9, 2002, NOAA Fisheries published the final rule (67 FR 45393) implementing all the measures identified in the RPA to reduce the incidental catch and post-release mortality of sea turtles and other protected species in HMS fisheries. The rule implemented the closure of the NED statistical reporting area, required the length of any gangion to be 10 percent longer than the length of any floatline if the total length of any gangion plus the total length of any floatline was less than 100 meters, prohibited vessels from having hooks on board other than corrodible, non-stainless steel hooks, and required all HMS bottom and pelagic longline vessels to post sea turtle handling and release guidelines in the wheelhouse. The final rule additionally established regulations for the HMS shark gillnet fishery that required: both the observer and vessel operator to look for whales; the vessel operator to contact NOAA Fisheries if a listed whale was taken; and shark gillnet fishermen to conduct net checks every 0.5 to 2 hours to look for and remove any sea turtles or marine mammals from their gear. NOAA Fisheries did not implement the gangion placement requirement because it was found to result in an unchanged number of interactions with loggerhead sea turtles and an apparent increase in interactions with leatherback sea turtles.

On August 1, 2003, NOAA Fisheries published a proposed rule for Draft Amendment 1 to the HMS FMP. Amendment 1 dealt exclusively with measures affecting the management of sharks and the directed shark fishery components (i.e*.,* bottom longline, Southeast shark drift gillnet, and recreational shark fisheries) of the HMS FMP. NOAA Fisheries determined there was a need for a new formal consultation on the effects of the directed shark fisheries on listed species because of new information obtained subsequent to the June 14, 2001, opinion, as well as the recent listing of smalltooth sawfish (*Pristis pectinata*). The proposed rule and new information was limited to directed shark fisheries and did not affect pelagic longline fishing effort or fishing patterns previously analyzed in the June 2001 opinion, therefore, the scope of the reinitiated consultation was focused on the directed shark fisheries.

On October 29, 2003, the Southeast Regional Office completed its opinion on the continued operation of Atlantic shark fisheries under the HMS FMP and Amendment 1. The opinion concluded that the continued prosecution of the Atlantic shark fisheries was not likely to jeopardize the continued existence, or destroy or adversely modify critical habitat, of any ESA-listed species. An ITS was included that specified the extent of anticipated take of sea turtles and smalltooth sawfish and the reasonable and prudent measures necessary to minimize the impacts of the take. For the directed shark fisheries, the October 29, 2003, opinion superceded the June 14, 2001, opinion.

The RPA of the June 14, 2001, opinion required NOAA Fisheries to initiate and conduct a cooperative research program which would develop, modify, and test gear technologies and fishing strategies to "(1) reduce the likelihood of interactions between fishing gear and sea turtles and (2) dramatically reduce immediate and delayed mortality rates of sea turtles captured in the fisheries." The RPA went on to require;

> 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 percent. 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.

1.2 Present Consultation

Over the course of 2001, 2002, and 2003, the SEFSC undertook a series of research activities in coordination and collaboration with the HMS pelagic longline fishery, academic partners, and other NOAA Fisheries researchers to complete the above-prescribed research program. Three seasons of field experiments were conducted aboard commercial longline vessels working in the NED under an ESA Section 10(a)(1)(A) scientific research permit. These studies, collectively known as the NED experiment, evaluated various fishing techniques in regard to their effectiveness at reducing sea turtle bycatch. The studies additionally evaluated safe-handling techniques to reduce post-release mortality for sea turtles. On March 3, 2004, the SEFSC submitted a final report to NOAA Fisheries' Office of Protected Resources (OPR) per section 10 permitting reporting requirements, summarizing the results of the 3-year NED experiment. The report (discussed in detail in section 4) was made available on the SEFSC's Pascagoula Laboratory website (http://www.mslabs.noaa.gov/mslabs/docs/pubs.html).

On September 15, 2003, the HMS Division sent a memorandum to the OPR regarding a proposed rule that would implement modifications to the U.S. quota for swordfish. This proposed rule responded to recommendations put forth by ICCAT at its 2002 meeting. The HMS Division sought concurrence with their conclusion that the proposed rule would not be expected to alter fishing practices or fishing effort any way that would alter the conclusions of the June 14, 2001, opinion. The memorandum and its supporting documents were subsequently forwarded to SERO-PRD for review.

While SERO-PRD's consultation was underway on this proposed rule, on November 17, 2003, the SEFSC notified HMS Division and SERO-PRD that the total takes specified in the June 14, 2001, opinion's ITS had been exceeded in 2002 for loggerheads and in 2001 and in 2002 for leatherbacks. The SEFSC issued a final report on the estimated bycatch levels in the longline fishery on December 12, 2003 (Garrison 2003a). Staff from SERO-PRD and the HMS Division began investigating potential causes of the excess take, effectively initiating consultation in November 2003.

Based on this new information, NOAA Fisheries determined that a more comprehensive management strategy might be needed for the HMS pelagic longline fishery. Further consultation on the proposed rule to implement the U.S. quota for swordfish was postponed pending consideration of additional management actions. NOAA Fisheries announced a Notice of Intent (NOI) (68 FR 66783, November 28, 2003) to prepare an SEIS to assess the potential effects on the human and biological environment from such a comprehensive management strategy.

On January 12-13, 2004, NOAA Fisheries hosted a workshop with industry representatives and other interested constituents to present the preliminary results of the NED experiment. In addition, NOAA Fisheries provided the workshop participants with an overview of the NOI, the time-line for rulemaking, and the associated ESA section 7 consultation process to implement sea turtle conservation measures.

Because of the expansion of proposed actions, on January 29, 2004, OSF sent a memorandum to SERO-PRD requesting formal acknowledgment that the ongoing consultations between HMS Division and SERO-PRD represented a reinitiation of consultation on the HMS pelagic longline fishery, pursuant to ESA Section 7. That memorandum noted that the application of the results of the NED experiment would allow the formulation of a new fishery management regulatory regime for the HMS pelagic longline fishery. This new management strategy would meet the June 14, 2001, opinion's requirement for the fishery to sustain a multi-year reduction in take and mortality of loggerhead and leatherback sea turtles, thereby avoiding jeopardy for those species. The memorandum also stated that a final rule to implement this new management strategy was expected to go into effect in June 2004.

On February 3, 2004, SERO concurred with the need to reinitiate Section 7 consultation, as the proposed rulemaking was expected to change significantly the extent and the manner in which the HMS pelagic longline fishery interacts with sea turtles. The SERO-PRD offered to provide advice and assistance to the HMS Division during the development of their sea turtle conservation rulemaking.

On February 11, 2004, NOAA Fisheries published the subject proposed rule and announced the availability of the DSEIS (69 FR 6621), with a comment period extending through March 15, 2003. Through the proposed measures, NOAA Fisheries sought to reopen the NED closed area and implement the gear modification results from the NED experiment throughout the fishery, including certain hook and bait measures proven to be effective at reducing sea turtle interactions and bycatch mortality. The intent of the proposed rule was to reduce bycatch and bycatch mortality of sea turtles caught incidentally in the HMS pelagic longline fishery.

On April 20, 2004, OSF informed SERO-PRD that they were considering revising the actions in the final rule from those described in the proposed rule. The potential revisions were based on public comment received during the comment period, as well as information regarding sea turtle mortalities derived from refined post-hooking mortality estimates, changes in the environmental baseline of the June 14, 2001, opinion for Atlantic sea turtles including new turtle excluder device requirements in the shrimp fishery, and a re-examination of data pertaining to reductions in bycatch and bycatch mortality associated with various hook and bait combinations. The OSF requested that the SERO-PRD opinion be prepared based on the changes to the details of the hook and bait requirements being considered for the final rule. The OSF also reiterated its request that the consultation consider the proposed rule implementing the North and South Atlantic swordfish quotas. It was further requested that the consultation consider exempted fishing permits (EFPs) and scientific research permits (SRPs) issued under the HMS FMP. Lastly, OSF requested that the consultation consider removal of the current reporting requirement for operators of HMS pelagic longline vessels. Operators are required to call NOAA Fisheries by telephone within 48 hours of returning to port to report any sea turtles that were dead when captured, or that died during capture. This request was based on the Office of Management and Budget’s directive for NOAA Fisheries to review and eliminate duplicative reporting requirements. NOAA Fisheries already collects the above information thorough the observer and logbook programs, and no reports had been received by telephone. Considering this requirement adds no monitoring value beyond observer and logbook program requirements, the SERO-PRD will no longer include this requirement as a term and condition.

The proposed regulatory actions are specific to the HMS pelagic longline fishery that targets tuna, swordfish, and pelagic sharks, and not any of the other fisheries under the HMS FMP or Billfish FMP. As previously discussed, the June 14, 2001, opinion evaluated the entire HMS FMP comprehensively, including all of its separately managed fisheries. The October 29, 2003, opinion superceded the June 14, 2001, opinion, for the directed shark fisheries only. In a similar manner, the proposed regulatory action would affect only the HMS pelagic longline fishery. Thus, this opinion will only evaluate the HMS pelagic longline fishery in regard to their effects on ESA-listed species under purview of NOAA Fisheries.

In summary, this reinitiated consultation evaluates the effects on listed species by the HMS pelagic longline fishery: (1) as it is currently being prosecuted, including fishing under EFPs and SRPs, and (2) as it would be prosecuted under the proposed regulations that require new sea turtle bycatch and mortality reduction measures. The effects of the proposed rule to implement the 2002 ICCAT swordfish quota recommendations are also evaluated in this consultation. For the HMS pelagic longline fishery, this opinion will supersede the June 14, 2001, opinion. There is no new information suggesting that the manner or extent of effects to any listed species from the remaining fisheries under the HMS FMP (i.e., purse seine, harpoon, hand line, rod-and-reel fisheries) has changed. Reinitiation of consultation is not required for those fisheries, and the June 14, 2001, opinion and its no-jeopardy conclusion still apply for those fisheries.

2.0 DESCRIPTION OF THE PROPOSED ACTION

The HMS Division proposes to promulgate regulations for the continued authorization and management of the HMS pelagic longline fishery for tunas and swordfish. The action would modify the HMS FMP and regulations at 50 CFR part 635 under the authority of Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the Atlantic Tunas Convention Act (ATCA). The MSA is the principle federal statute governing the management of U.S. marine fisheries. The management units covered under the HMS FMP consist of the populations of swordfish (*Xiphias gladius*), bluefin tuna (*Thunnus thynnus*), yellowfin tuna (*T. albacares*), bigeye tuna (*T. obesus*), albacore tuna (*T. alalunga*), skipjack tuna (*Katsuwonus pelamis*), and the species of sharks that inhabit the western North Atlantic Ocean. The management units and fishing activity for these species extend across federal, state, and international jurisdictional boundaries. For the purposes of the FMP, each stock is identified as "Atlantic" (i.e., Atlantic bluefin tuna). Tunas and swordfish are also subject to recommendations made by ICCAT, which is responsible for the international conservation and management of tuna and tuna-like fishes. The ATCA provides the authority to issue regulations may be necessary and appropriate to implement ICCAT recommendations.

The authority to develop fishery management plans, including the HMS FMP, is established by the MSA. The goal of the HMS FMP is to maximize to the region and nation the net benefits of the fisheries regulated by the FMP. Some of the objectives stated in the FMP are summarized as follows:

- to rebuild overfished stocks
- to avoid and reduce bycatch and bycatch mortality
- to establish a foundation for international negotiation on conservation and management measures to rebuild overfished fisheries
- to better coordinate domestic conservation and management of the fisheries for Atlantic tunas, swordfish, sharks, and billfish, considering the multi-species 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, 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.

NOAA Fisheries is required to avoid and reduce fishing bycatch and bycatch mortality to the extent practicable under national and international laws and agreements, including the MSA, the Marine Mammal Protection Act (MMPA), the ESA, and through recommendations of ICCAT.

In recent years, NOAA Fisheries has taken action to avoid jeopardy of Atlantic sea turtles in the HMS fisheries by implementing measures to mitigate mortality and minimize bycatch (see Section 1.0, Consultation History). The MSA further requires NOAA Fisheries to minimize the adverse economic impacts of regulations on fishing communities to the extent practicable.

The proposed regulations are necessary to reduce bycatch and bycatch mortality of sea turtles caught incidentally in the Atlantic HMS pelagic longline fishery, consistent with the requirements of the ESA, and to implement the 2002 ICCAT swordfish quota recommendations. Summary information describing the HMS pelagic longline fishery and the proposed regulations is presented below. Further detail regarding the proposed regulations can be found in the proposed rule and DSEIS. Additional information on the HMS pelagic longline fishery and the status of target species stocks can be found in numerous other documents, including the Final HMS FMP Volumes I, II, and III (April 1999), 15 CFR Part 902 and 50 CFR Part 635 et al., Amendment 1 to the Atlantic Billfish Fishery Management Plan (April 1999), Regulatory Amendment One to the HMS FMP (NMFS 2000a), and the 2000 - 2004 Stock Assessment and Fishery Evaluation Reports.

2.1 Description of the HMS Pelagic Longline Fishery

U.S. pelagic longline fishermen began targeting highly migratory species in the Atlantic Ocean in the early 1960s. U.S. landings of swordfish did not exceed 1,500 metric tons until the mid-1970s. The gear used in the fishery has evolved over time. Presently, fishermen use monofilament mainline that is rigged with various hook and float configurations depending on whether the target is tunas or swordfish. Pelagic longline fishermen locate fish by looking for temperature fronts between cooler and warmer water masses and typically set the gear across these breaks. These temperature fronts are often associated with currents, specifically the Gulf Stream Current, thus much of the fishing effort is associated with the edges of these currents. In recent years, the availability of high resolution satellite-generated sea surface temperature data has greatly influenced landings.

The HMS pelagic longline fishery primarily targets swordfish, yellowfin tuna, or bigeye tuna in various areas and seasons. Secondary marketable species include dolphin; albacore tuna; and pelagic sharks including mako, thresher, and porbeagle sharks; as well as several species of large coastal sharks. Permit holders range from Maine to Texas, and fishing techniques vary by region according to target species. The HMS pelagic longline fishery is comprised of five relatively distinct segments, including the: Gulf of Mexico yellowfin tuna fishery; southern Atlantic (Florida East Coast to Cape Hatteras) swordfish fishery; mid-Atlantic and New England swordfish and bigeye tuna fishery; U.S. Atlantic Distant Water swordfish fishery; and Caribbean tuna and swordfish fishery. In addition to geographical distinctions, these segments contribute differing percentages of various target and non-target species. The different segments also use differing gear types, bait, and deployment techniques. Fishing characteristics are dependent on a specific vessel's range capabilities based on fuel capacity, hold capacity, size, and construction. Some vessels fish in more than one segment, targeting different species during the course of the

The number of hooks per set varies with line configuration and target catch (Table 2.1.1). In recent years, the HMS pelagic longline fishery has used "J" hooks almost exclusively. When targeting swordfish, the lines generally are deployed at sunset and hauled at sunrise to take advantage of swordfish nocturnal near-surface feeding habits (Berkeley et al.1981). Some fishing captains preferentially target swordfish during periods when the moon is in its full or waxing phase to take advantage of increased densities of pelagic species near the surface. Other captains prefer fishing on the new moon phase, but again while the moon is waxing. Pelagic longlines targeting tunas (primarily yellowfin) are set in the morning (pre-dawn) , deeper in the water column, and hauled in the evening.

Table 2.1.1 Average Number of Hooks per pelagic longline set, 1995-2002. Source: Longline logbook data.

Target Species	1995	1996	1997	1998	1999	2000	2001	2002
Swordfish	539	529	550	563	521	550	625	695
Bigeye Tuna	752	764	729	688	768	454	671	755
Yellowfin Tuna	721	679	647	685	741	772	731	715
Mix of tuna species	NA	NA	NA	NA	NA	638	719	767
Mix of species	658	695	713	726	738	694	754	756

2.1.2 Pelagic Longline Target Species

2.1.2.1 Swordfish

Swordfish (*Xiphias gladius)* are large migratory predators that are distributed globally in tropical and subtropical marine waters. In the western Atlantic, swordfish range from Canada to Argentina. These large pelagic fishes feed throughout the water column on a wide variety of prey including groundfish, pelagics, deep-water fish, and invertebrates. Swordfish show extensive diel migrations and are typically caught on pelagic longlines at night when they feed in surface waters. Their broad distribution, large spawning area, and prolific nature have contributed to the resilience of the species in spite of the heavy fishing pressure being exerted on it by many nations. During their annual migration, north Atlantic swordfish follow the major currents that circle the north Atlantic Ocean (including the Gulf Stream, Canary and North Equatorial Currents), and the currents of the Caribbean Sea and Gulf of Mexico. The primary habitat in the western north Atlantic is the Gulf Stream, which flows northeasterly along the U.S. coast then turns eastward across the Grand Banks, the primary area within the NED where HMS pelagic longlining occurs. North-south movement of swordfish along the eastern seaboard of the United States and Canada is significant (SAFMC 1990).

In 2002, the estimated swordfish catch by U.S. vessels in the western Atlantic, including dead discards, was 2,708.7 metric tons (mt) (NOAA Fisheries 2003). This represents a modest increase of 55.4 mt from 2001, but a 22.5 percent decrease from 2000. The pelagic longline fishery operates year-round in all pelagic waters of the U.S. EEZ and beyond, and currently accounts for approximately 98 percent of the U.S. domestic swordfish landings. About 16 to 31 percent of U.S. swordfish landings are harvested on the Grand Banks.

NOAA Fisheries believes that the existing license limitation system and restrictions on upgrading to a higher license class has capped the number of U.S. vessels fishing on the Grand Banks and effort has decreased. The NOAA Fisheries Pelagic Logbook Newsletter reports that 22 U.S. vessels fished on the Grand Banks in 1996 and 1997 (making 710 and 762 sets, respectively), and only 15 U.S. vessels fished on the Grand Banks 1998 (618 sets). Beideman (2001, pers. comm.) reported that in the 1990s there were more than 60 longline vessels fishing the Grand Banks, but only 10-12 vessels fished there in 2000. It appears that pelagic longline effort in the Grand Banks has steadily decreased over the past few years, but there is a possibility for a change.

Effective December 3, 2003, an agreement between Canada and the United States allows U.S. fishermen to apply for a license to conduct activities in Canadian waters and ports. This agreement may lead to additional effort in the NED in excess of projected levels. Additional vessels may participate in the fishery, or there may be an increased number of trips because of a shortened steaming time to and from Canadian ports. These potential increases in effort are not quantifiable at this time. However, data over the last six years indicate that less than 12 vessels, on average, fished in the NED. NOAA Fisheries will monitor effort in the NED and modify its management strategy as appropriate.

2.1.2.2 Atlantic Tuna

Tunas are highly migratory fish found in many of the world's tropical, subtropical, and temperate ocean regions. Bluefin (*Thunnus thynnus*), bigeye (*Thunnus obesus*), albacore (*Thunnus alalunga*) and skipjack (*Katsuwonus pelamis*) tunas are widely distributed throughout the Atlantic. Yellowfin tuna (*Thunnus albacores*) are considered to be a more tropical species. Smaller yellowfin tuna form mixed schools with skipjack tuna and juvenile bigeye tuna and are mainly limited to surface waters, whereas larger yellowfin tuna are found in surface and sub-surface waters. Bigeye tuna inhabit waters deeper than those of any other tuna species and undertake extensive vertical movements. Albacore tuna also tend to inhabit deep waters, except when young. Many of these tunas are opportunistic feeders, eating mainly fish and squid (SCRS 1999). Commercial and recreational fishermen from numerous countries participate in fisheries for several species of Atlantic tuna.

In 2002, the estimated tuna catch by U.S. pelagic longline vessels in the western Atlantic, including dead discards, was 3,252 metric tons (mt) (NOAA Fisheries 2003). Yellowfin tuna dominated tuna landings by weight (2,542 mt), with the pelagic longline fishery accounting for approximately 43 percent of those landings.

2.1.2.3 Pelagic Sharks and Other Finfish

Pelagic sharks are commonly caught by the pelagic longline fishery. Pelagic sharks include the following species that are commonly caught on pelagic longlines: shortfin mako, porbeagle, common thresher, and blue sharks. Other pelagic shark species, such as longfin mako, sixgill, bigeye sixgill, and sevengill sharks are occasionally or rarely taken. Several commercially valuable species of finfish are also caught by the pelagic longline fishery, including dolphin (*Coryphaena hippurus*), and wahoo (*Acanthocybium solanderi*).

2.1.3 U.S. Atlantic Pelagic Longline Fishery Catches Catch in Relation to International Catches

Table 2.1.3 A summarizes the total catch (in numbers) of important species caught during 1995 through 2002 in the U.S. pelagic longline fishery.

Table 2.1.3 A Reported catch of species caught by U.S. Atlantic pelagic longlines, in number of fish 1995-2002. Reported in pelagic longline logbook.

Species	1995	1996	1997	1998	1999	2000	2001	2002
Swordfish Kept	72,788	73,111	68,274	68,345	64,370	60,101	49,220	49,360
Swordfish Discarded	29,789	23,831	20,613	22,579	20,066	16,711	14,448	13,039
Blue Marlin Discarded	3,091	3,310	2,614	1,291	1,248	338	164	401
White Marlin Discarded	3,432	2,924	2,812	1,490	1,971	504	295	709
Sailfish Discarded	1,195	1,443	1,766	827	1,404	517	61	158
Spearfish Discarded	445	553	390	105	156	79	29	51
Bluefin Tuna Kept	239	209	180	206	239	232	183	178
Bluefin Tuna Discarded	2,852	1,709	688	1,304	601	737	348	593
Bigeye, Albacore, Yellowfin, Skipjack Tunas Kept	120,548	85,964	102,798	75,268	99,957	94,677	82,973	80,104
Pelagic Sharks Kept	5,885	5,270	5,134	3,624	2,705	2,932	3,511	2,997
Pelagic Sharks Discarded	90,173	84,330	82,220	44,000	28,910	26,281	23,953	22,844
Large Coastal Sharks Kept	57,676	36,022	21,382	8,742	1,025	7,752	6,510	4,077
Large Coastal Sharks Discarded	11,013	10,403	8,243	5,908	5,774	6,800	4,891	3,815
Dolphin Kept	72,463	35,888	62,811	21,864	29,902	28,095	27,913	30,452
Wahoo Kept	4,976	3,635	4,570	4,303	4,112	3,887	3,084	4,212
Sea Turtles Discarded	1,142	498	267	885	627	270	421	465
Number of Hooks (X 1,000)	*11,064*	*10,657*	*9,861*	*7,676*	*7,488*	*7,570*	*7,740*	*7,151*

The U.S. HMS fleet is a small part of the international fleet that competes on the high seas for catches of tunas and swordfish (Table 2.1.3 B). In 1990, the U.S. fleet landed as much as 35 percent of the swordfish from the north Atlantic, north of 5º N latitude, but this proportion decreased to 25 percent by 1997. For tunas, the U.S. proportion of landings was 23 percent in 1990, decreasing to 16 percent by 1997. The U.S. fleet accounts for almost none of the landings of swordfish and tuna from the Atlantic Ocean south of 5º N latitude, and it does not operate in the Mediterranean Sea. Tuna and swordfish landings by foreign fleets operating in the tropical Atlantic and Mediterranean are greater than the catches from the north Atlantic area where the U.S. fleet operates. Within the area where the U.S. fleet operates, the U.S. portion of fishing effort (in numbers of hooks fished) is less than 10 percent of the international fleet's effort. Even this low estimate may be inflated because of differences in effort reporting methods among ICCAT countries (NMFS SEFSC 2001).

Because some ICCAT nations do not monitor incidental catches of sea turtles, it is not possible to accurately assess the impact of international fishing efforts on sea turtles. However, high absolute numbers of sea turtle catches by the foreign fleets have been reported from other sources (NMFS SEFSC 2001, Lewison et al. 2004). If the sea turtle catch rates by foreign fleets are similar to the catch rates of the American fleet, then the American fleet may represent less than one-tenth, and certainly no more than one-third, of the total catch and mortality of sea turtles in north Atlantic pelagic longline fisheries.

Table 2.1.3 B Estimated International Longline Landings of HMS, Other than Sharks, for All Countries in the Atlantic: 1998-2002 (mt wet weight)*. Source: SCRS, 2003

	1998	1999	2000	2001	2002
Swordfish (N.Atl + S. Atl)	24,432	25,201	24,990	21,773	21,770
Yellowfin Tuna (W. Atl)**	8,795	11,596	11,465	12,535	12,141
Bigeye Tuna	71,825	76,513	70,902	54,842	43,773
Bluefin Tuna (W. Atl.)**	764	914	859	610	727
Albacore Tuna (N. Atl + S. Atl)	23,574	27,209	28,881	28,959	27,491
Skipjack Tuna (N. Atl + S. Atl)	99	51	60	70	88
Blue Marlin (N. Atl. + S. Atl.)***	2,519	2,359	2,187	1,638	1,247
White Marlin (N. Atl. + S. Atl.)***	918	981	893	592	705
Sailfish (W. Atl.)***	1,058	524	811	812	1,050
Total	**133,984**	**145,348**	**141,048**	**121,831**	**108,992**
U.S. Longline Landings (from U.S. Natl. Report, 2003)#	**7,139.9**	**8,356.0**	**7,319.7**	**6,012.0**	**5893.2**
U.S. Longline Landings as a Percent of Total Longline Landings	**5.3**	**5.7**	**5.2**	**4.9**	**5.4**

* Landings include those classified by the SCRS as longline landings for all areas
** Note that the United States has not reported participation in the E. Atl yellowfin tuna fishery since 1983 and has not participated in the E. Atl bluefin tuna fishery since 1982.
***Includes U.S. *dead discards.*
Includes swordfish longline discards and bluefin tuna discards.

2.1.4 Management of the HMS Longline Fishery

Pelagic longlines are a highly regulated gear type due to the nature of the gear and its catch and bycatch. Minimum sizes are established for yellowfin, bigeye, and bluefin tuna, and swordfish to reduce the mortality of small fish. There are target species catch limits associated with a vessel's ability to retain bluefin tuna. Billfish regulations prohibit the retention of billfish by commercial vessels, or the sale of billfish taken from the Atlantic; therefore, all billfish must be discarded. 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 effectively avoid undersized fish or other regulatory discards in some areas, NOAA Fisheries has closed areas in the Gulf of Mexico and along the east coast of the U.S. (see Figure 2.3.1.C). The intention of these closures is to relocate some of the fishing effort into areas where bycatch is expected to be lower. To facilitate enforcement of the time/area closures, all pelagic longline vessels are required to use vessel monitoring systems (VMS), which report the location of the vessel at all times.

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, since 1992, pelagic longline fishermen have been subject to permitting and reporting requirements, including logbooks and observer coverage. The pelagic longline reporting program is managed by the SEFSC. In 1999, NOAA Fisheries 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 possess swordfish, shark, and tuna longline category permits. NOAA Fisheries is currently re-evaluating the limited access program and may consider gear-specific permits in the future. As of November 2003, approximately 235 tuna longline limited access permits had been issued. In addition, approximately 203 directed swordfish limited access permits had been issued.

HMS fish dealers are also subject to reporting requirements. NOAA Fisheries has extended dealer permitting and reporting requirements to all swordfish importers as well as dealers who buy domestic swordfish taken from the Atlantic. These data are used to evaluate the impacts of harvesting on the stock and the impacts of regulations on affected entities.

2.1.5 Management of HMS Pelagic Longline Fishing EFPs and SRPs

Every year, NOAA Fisheries issues a small number of exempted fishing permits (EFPs) and scientific research permits (SRPs) under the MSA, authorizing the collection of a limited number of HMS from federal waters in the Atlantic Ocean using pelagic longline gear. These catches are for the purposes of scientific data collection and/or public display. On November 10, 2003, NOAA Fisheries issued a final rule that modified regulations for HMS fishing activities conducted under EFPs and SRPs (68 FR 63738). The new regulations are intended to improve accountability of these fishing activities through increased monitoring and additional reporting requirements. Under these regulations (effective December 10, 2003):

- EFP holders must notify their local NOAA Fisheries Office for Law Enforcement at least 24 hours prior to departure for all fishing trips conducted to collect HMS for the purpose of public display;
- All live HMS retained for the purpose of public display must be tagged while still on board the fishing vessel with either a conventional dart tag or a microchip Passive Integrated Transponder (PIT) tag, both of which will be supplied by NOAA Fisheries;
- If warranted, NOAA Fisheries may specify conditions for conducting fishing activities to collect HMS for public display to minimize mortalities of either targeted or bycatch species;
- NOAA Fisheries reserves the right to place an at-sea observer on board an authorized HMS collection vessel;
- EFP and SRP holders must report all HMS collection activities regardless of whether they occur inside or outside the Exclusive Economic Zone (EEZ);
- Negative reports must be submitted for months when no HMS are collected;

- To obtain a new permit, applicants for EFP and SRP renewals must include with the application the previous year's year-end report and any delinquent reports for permits issued in prior years;
- For the pelagic longline directed swordfish fishery, separate EFPs are no longer required to delay offloading swordfish for vessels equipped with an operational VMS; and
- Several prohibitions are established concerning the submission of false information and violations of the terms and conditions of EFPs and SRPs to facilitate enforcement of EFP application and reporting requirements.

Many of the EFPs and SRPs involve fishing with pelagic longline gear by commercial or research vessels, similar or identical to the fishing methods of the pelagic longline fishery, which is the primary object of this opinion. In those cases, the types and rates of interactions with listed species from the EFP or SRP activity would be expected to be similar to those from the larger pelagic longline fishery. If the fishing type is similar, and the associated fishing effort does not represent a significant increase over the effort levels for the overall fishery considered in this opinion, then issuance of some EFPs or SRPs would be expected to fall within the level of effort and impacts considered in this opinion. For example, issuance of an EFP to an active commercial vessel likely does not add additional effects than would otherwise accrue from the vessel's normal commercial activities. Also, issuance of an EFP to a research vessel to conduct a limited number of pelagic longline sets likely would not add sufficient fishing effort to produce a detectable change in the overall amount of fishing effort in a given year. With the improved monitoring and reporting of EFPs and SRP fishing activities as a result of the December 10, 2003, regulations, reported fishing effort, and any associated listed species turtle takes, will be documented. Those data will be combined with the HMS pelagic longline fishery data. Any impacts on protected species from EFP and SRP fishing activities, therefore, can be included in bycatch analysis for the HMS pelagic longline fishery. Therefore, we consider the issuance of some EFPs and SRPs by HMS Division to be within the scope of this opinion. The included EFPs and SRPs would be those that involve fishing with pelagic longline gear, consistent with the requirements of section 2.2 below, and that are not expected to increase fishing effort significantly.

HMS Division may consider issuance of EFPs or SRPs meeting these conditions to be covered by this consultation, and takes of sea turtles would be included against the authorized take levels of this opinion. HMS Division must minimize sea turtle bycatch and bycatch mortality from EFP and SRP fishing activities by specifying permit conditions similar to the requirements under which the HMS pelagic longline fishery operates (e.g., hook type, handling and release equipment). If in doubt whether a particular EFP or SRP is consistent with this consultation, HMS Division should seek the concurrence of SERO. For EFPs and SRPs that are not covered under this consultation, separate consultation, pursuant to section 7 of the ESA, may be required prior to issuance of the permits.

2.1.6 Pelagic Observer Program

The SEFSC Miami Laboratory has been responsible for the administration of the Pelagic Observer Program (POP) since 1992. NOAA Fisheries places observers aboard HMS-permitted vessels under the authority of the MSA, as well as the MMPA and ESA. The objective and mission of the POP is to document the effort, directed catch, and bycatch, as well as collect data on species morphometrics and biological characteristics. Additionally, the program documents fishery interactions with marine mammals, sea turtles, and birds. The observer data are used to estimate catch of target species, bycatch of non-target species, and the incidental take of protected species.

Observer coverage is based on number of sets reported by the U.S. pelagic longline fleet in the eleven statistical reporting areas (Figure 2.3.1.C) of the North Atlantic Ocean (north of 5 deg. N latitude). Vessels are issued a certified letter prior to the start of a calendar quarter indicating that they have been randomly chosen for observer coverage and must schedule an observer trip with the POP within the quarter that the vessel was chosen. Five percent coverage was the sampling target for the POP until 2002. The five percent level was required both for ICCAT reporting and by the June 14, 2001, opinion. The sampling fraction has varied from 2.5 to more than 5 percent, depending on available resources. In 2002, the POP raised their target coverage level to 8 percent, to meet new ICCAT targets and to improve the precision of catch and bycatch estimates specified in NOAA Fisheries' guidelines for fisheries observer coverage levels (NMFS 2003). NOAA Fisheries strives to achieve coverage levels that will yield a 20-30 percent coefficient of variation for bycatch estimates regarding protected species. In 2002, 856 pelagic longline sets were observed and recorded by the POP (8.9 percent overall coverage: 100 percent coverage in the NED experiment and 3.7 percent coverage in remaining areas). Table 2.3.6 compares the amount of observer coverage in past years for this fleet.

Table 2.3.6 Observer Coverage of the Pelagic Longline Fishery.
Source: Yeung (2001) and Garrison (2003a)

Year	Number of Sets Observed			Percentage of Total Number of Sets		
1995	696			5.2		
1996	361			2.5		
1997	448			3.1		
1998	287			2.9		
1999	420			3.8		
2000	464			4.2		
2001*	Total	Non-NED	NED	Total	Non-NED	NED
	403	217	186	3.7	2.0	100.0
2002*	856	353	503	8.9	3.7	100.0

*In 2001 and 2002, 100 percent observer coverage was required in the NED experimental fishery.

2.2 Proposed Regulations for the Atlantic Pelagic Longline Fishery

NOAA Fisheries is proposing new regulations for the Atlantic pelagic longline fishery to reduce sea turtle bycatch and bycatch mortality (69 FR 6621, February 11, 2004). The multiple objectives of the regulations, as stated in the DSEIS, are:

- To be consistent with the objectives of the HMS FMP and all applicable laws;
- To implement measures proven during the NED research experiment to reduce sea turtle interactions;
- To avoid jeopardizing the continued existence of leatherback and loggerhead sea turtles by implementing new management measures within the U.S. Atlantic pelagic longline fishery intended to reduce or, at a minimum, prevent increases in incidental takes of sea turtles in this fishery and reduce the mortality associated with such interactions;
- To reconsider, in light of possible gear modifications, the NED closure and other time/area closures; and,
- To minimize, to the extent practicable, the economic impact of sea turtle bycatch mitigation measures on U.S. pelagic longline fishery participants.

The proposed change in management regime under the HMS FMP would affect commercial pelagic longline gear and fishermen targeting swordfish, tuna, and sharks. The DSEIS analyzed numerous alternatives, representing the range of options considered by NOAA Fisheries, to reduce the incidental catch and bycatch mortality of sea turtles in the pelagic longline fishery for Atlantic HMS. The alternatives ranged from no action to a total prohibition of the gear type, with alternatives A3 (hook and bait requirements outside the NED), A10 (hook and bait requirements for fishing in the NED), and A16 (gear removal and handling requirements for sea turtles), together, comprising NOAA Fisheries' Preferred Alternatives in the proposed regulations. As discussed in the Consultation History section of this opinion, those alternatives have subsequently been modified. The alternatives currently under consideration for the final rule are thus considered as part of the proposed action for this opinion.

NOAA Fisheries is also proposing to amend the regulations governing the North and South Atlantic swordfish fisheries. The proposed changes would implement recommendations adopted at the 2002 meeting of the ICCAT. These proposals are also considered part of the proposed action for this opinion.

2.2.1 Hook and Bait Requirements Outside the NED (Alternative A5 (b))

NOAA Fisheries is considering modifying its preferred alternative for this action from A3 to A5 (b). Alternative A5 (b) would limit vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only 16/0 or larger non-offset circle hooks and/or 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Offsets must be set by the manufacturer and not by the fishermen. Only whole finfish and squid baits may be possessed and/or utilized with allowable hooks. This alternative would maintain the current requirement for possession or use of non-stainless steel corrodible hooks, and the live-bait restriction in the western Gulf of Mexico.

2.2.2 Hook and Bait Requirements for Fishing inside the NED (Alternative A10 (b))

NOAA Fisheries is also considering modifying alternative A10 as A10 (b). Alternative A10 (b) would re-open the NED to pelagic longline fishing and limit vessels with pelagic longline gear onboard in that area, at all times, to possessing onboard and/or using only 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Only whole mackerel or squid baits may be possessed and/or utilized with allowable hooks. This alternative would maintain the current requirement for possession or use of non-stainless steel corrodible hooks.

2.2.3 Gear Removal and Handling Requirements for Sea Turtles to Reduce Post-Release Mortality (Alternative A16)

Alternative A16 would require vessel operators aboard all federally permitted vessels, or those required to be permitted, for Atlantic HMS with pelagic longline gear on board to possess and maintain line cutters and dipnets meeting newly revised design and performance standards. Alternative A16 would also require vessel operators to possess, maintain, and utilize additional sea turtle handling and release equipment and comply with handling and release guidelines, as specified by NOAA Fisheries, to facilitate the removal of fishing gear from incidentally captured sea turtles. The following additional or newly revised equipment would include:

A- (1) long-handled line cutter;
B- (1) long-handled dehooker for ingested hooks;

C- (1) long-handled dehooker for external hooks (the long-handled dehooker for ingested hooks used for item B will also satisfy this requirement);
D- (1) long-handled device to pull an “Inverted V” (if 6’ J-style dehooker is used for item C, it will also satisfy this requirement);
E- (1) dipnet;
F- (1) standard automobile tire;
G- (1) short-handled dehooker for ingested hooks;
H- (1) short-handled dehooker for removing external hooks (the short- handled dehooker for ingested hooks used for item G will also satisfy this requirement);
I- (1) long-nose or needle-nose pliers;
J- (1) bolt cutter;
K- (1) monofilament line cutter; and,
L- (2) types of mouth openers/mouth gags.

The use of items A - D would be required when sea turtles cannot be boated. The use of items E - L would be required when sea turtles can be boated. All equipment would be required to be used in accordance with the handling and release guidelines specified by NOAA Fisheries.

2.2.4 Proposed Adjustment of Swordfish Quota

Consistent with ICCAT recommendations, proposed regulations would establish annual quotas for North and South Atlantic swordfish, implement a dead discard allowance for the 2003 fishing year and beyond, allow 200 mt wet weight (ww) of North Atlantic swordfish quota to be taken in the area between 5 degrees North latitude and 5 degrees South latitude, and transfer 25 mt ww of North Atlantic swordfish to Canada. Specifically, the proposed rule would:

- Increase the United States North Atlantic swordfish quota to 3,877 mt ww in 2003 and 3,907 mt ww in 2004 and 2005;
- Allow 200 mt ww of the North Atlantic swordfish catch limit to be harvested from an area between 5 degrees North latitude and 5 degrees South latitude;
- Allocate the United States an 80 mt ww dead discard allowance in addition to the country specific quota allocation for North Atlantic swordfish;
- Transfer 25 mt ww of North Atlantic swordfish quota to Canada in 2003, 2004, and 2005; and
- Allocate the United States 100 mt ww of South Atlantic swordfish quota in 2003, 2004, and 2005 and 120 mt ww in 2006.

2.3 Action Area

The action area for a biological opinion is defined as all the areas affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). The HMS pelagic longline fishery operates in large areas of the Gulf of Mexico, the Caribbean

Sea, and the Atlantic Ocean, ranging throughout the U.S. EEZ and beyond. Figures 2.3.1. A and B illustrate the wide ranging nature of the longline fishery throughout the western North Atlantic.

Figure 2.3.1. C shows the statistical reporting areas for the HMS pelagic longline fishery and the existing regulatory closure areas. Area E (the NED) would be reopened to fishing under the proposed regulations. Close examination of Figures 2.3.1.A and B reveals that HMS pelagic longline vessels occasionally have reported sets or even observed sets in the closed areas, where their fishing was illegal, and in the EEZs of other nations under chartering arrangements. The HMS Division is currently aware of only three vessels that have, over the past year or two, fished under such arrangements off of Namibia, Brazil, and Uruguay. Based on that information, the HMS Division currently estimates that less than 10 HMS-permitted vessels may participate in chartering arrangements. HMS-permitted vessels fishing under a charter arrangements are still subject to U.S. regulations, including all monitoring and reporting requirements, unless otherwise exempted under exempted fishing permits. NOAA Fisheries recently published a proposed rule to establish chartering permits to better monitor such activities (69 FR 25357).

With the requirement that all longline vessels carry VMS, NOAA Fisheries' Office of Enforcement will now be able to detect and prosecute illegal incursions into closed areas or other nation's EEZs. In the future, therefore, we expect that the vast majority of longline fishing by the U.S. fleet will occur within areas of the U.S. EEZ and the high seas that are open to U.S. longliners, and on very rare occasions, in other nation's EEZ under a legal charter agreement. Throughout their wide-ranging fishing grounds, HMS fisheries may interact with listed species of sea turtles; therefore, the action area for this opinion includes all of these areas.

Figure 2.3.1 A and B. Pelagic longline fishing effort during 2001 (A) and 2002 (B). Locations of observed (dark circles) and reported (light circles) sets are indicated.

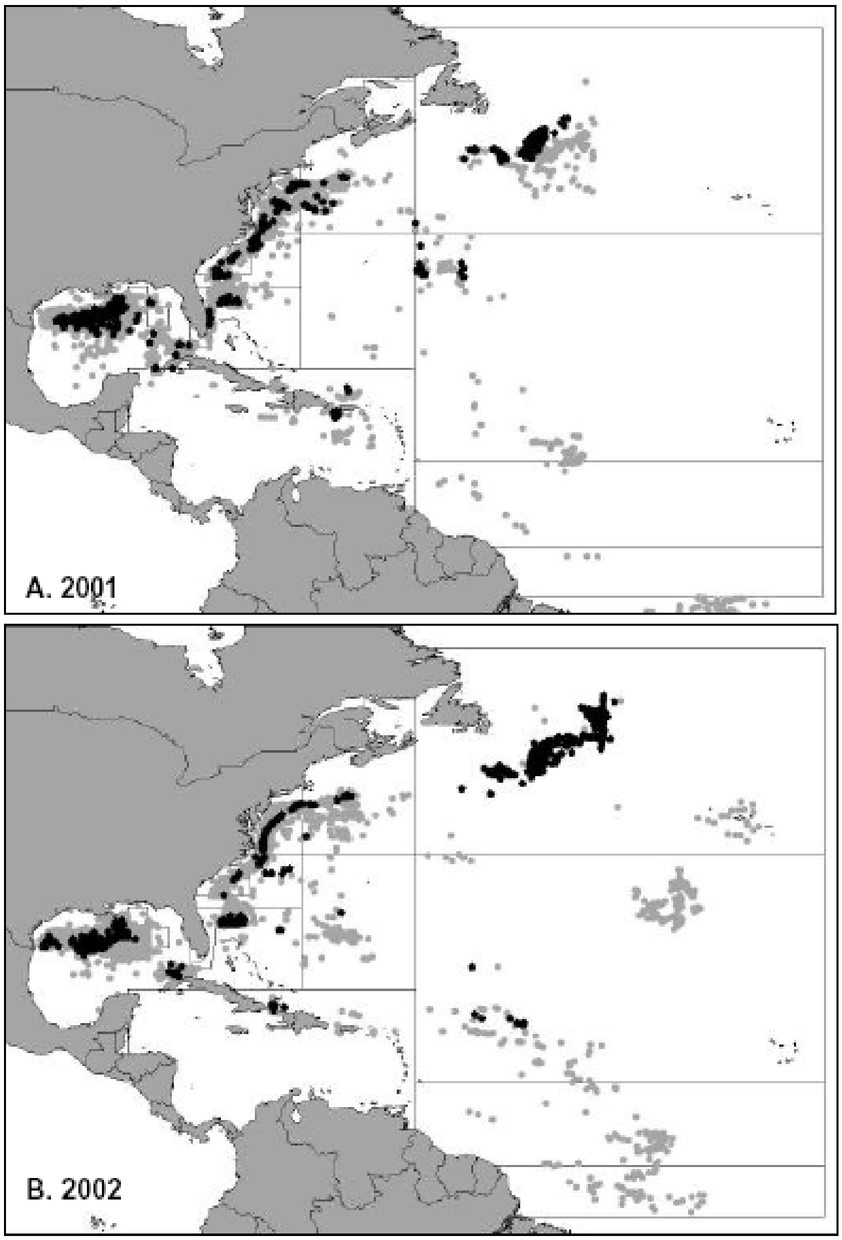
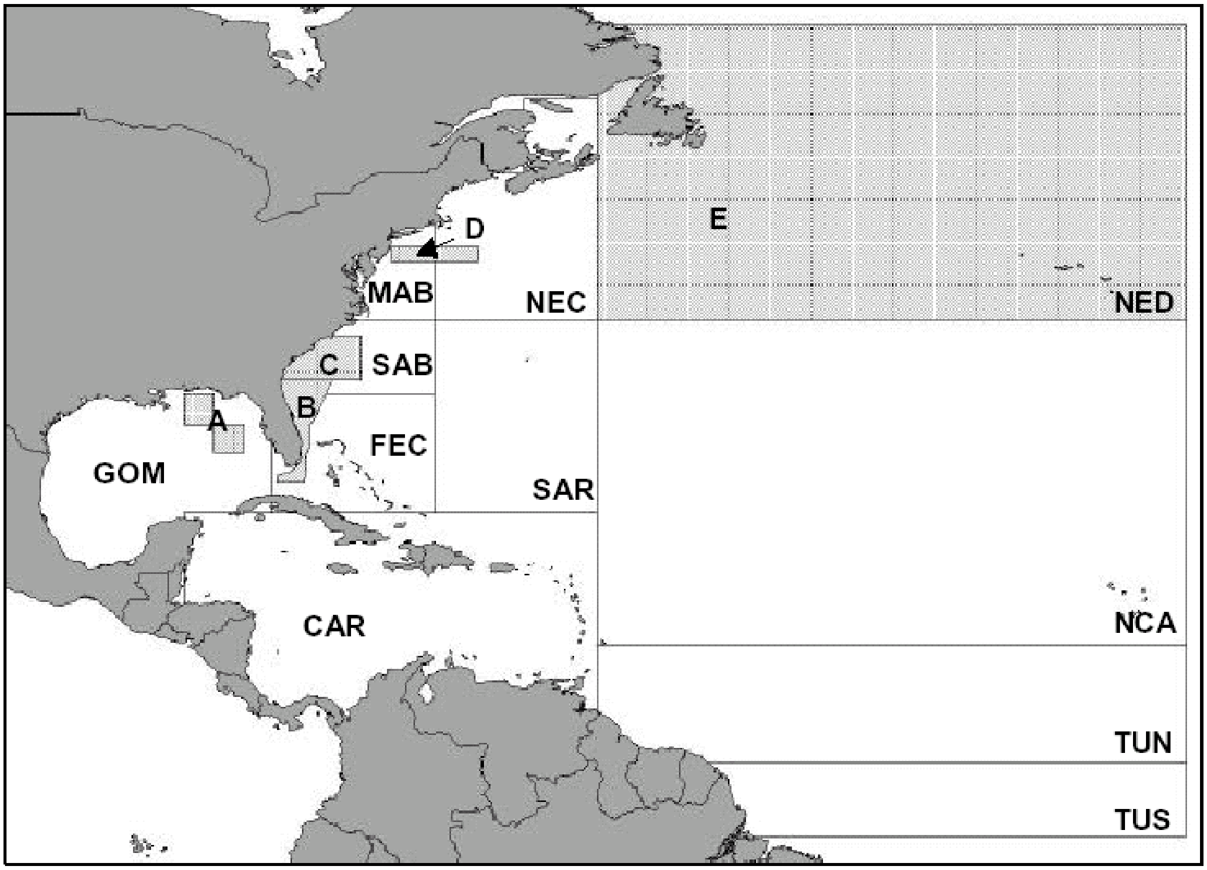


Figure 2.3.1 C. Pelagic longline fishing areas in the north Atlantic ocean indicating 11 defined fishing areas. CAR =Caribbean, GOM = Gulf of Mexico, FEC = Florida East Coast, SAB = South Atlantic Bight, SAR = Sargasso Sea, MAB = Mid-Atlantic bight, NEC = Northeast Coastal, NED = Northeast Distant, NCA = North Central tlantic, TUN = Tuna North, TUS = Tuna South. Pelagic longline closed areas are indicated by shaded polygons and letter labels (A-E). (Garrison 2003a)



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

3.1 List of Species and Critical Habitat

The following endangered and threatened species and designated critical habitat occur in the action area, as defined in Section 2.3, and may be affected by the proposed action.

Marine Mammals	**Status**
Blue whale (*Balaenoptera musculus*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Northern right whale (*Eubalaena glacialis*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Sea turtles	
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered
Green turtle (*Chelonia mydas*)	Endangered/Threatened
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered
Loggerhead sea turtle (*Caretta caretta*)	Threatened
Olive ridley turtle (*Lepidochelys olivacea*)	Threatened
Fish	
Smalltooth sawfish (*Pristis pectinata*)	Endangered
Gulf of Maine Atlantic salmon	Endangered
Critical Habitat	
Northern Right Whale (*Eubalaena glacialis*)	Endangered

**Green sea 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 the populations away from the nesting beaches, green sea turtles are considered endangered wherever they occur in U.S. waters.*

3.2 Analysis of the Species and Critical Habitat Not Likely to be Adversely Affected

We have determined that the proposed action being considered in this opinion is not likely to adversely affect the following listed species or critical habitat under the ESA: blue whale, sei whale, humpback whale, fin whale, Northern right whale, sperm whale, smalltooth sawfish, or right whale critical habitat. These species and critical habitat are therefore excluded from further analysis and consideration in this opinion. The following discussion summarizes our rationale for these determinations and conclusions.

3.2.1 Whales

Blue, sei, and sperm whales are predominantly found in offshore waters where pelagic longline fishing targeting HMS occurs. Observed or reported interactions between any of these species and pelagic longline gear are rare. There has been one observed entanglement of a sperm whale in the Hawaii-based Pacific pelagic longline fishery; that animal was released without any hooking injury or any trailing gear. Sperm whales have also been observed during hauling operations for longline fisheries in the southern hemisphere but there were no confirmed entanglements (Ashford et al. 1996; Nolan et al. 2000). With respect to the U.S. Atlantic pelagic longline fishery, the final Atlantic Offshore Cetacean Take Reduction Plan and a report by Scott and Brown (1997) stated that there is no evidence of interactions with offshore large whales. In the 12 years that NOAA Fisheries observers have been collecting data in the Atlantic longline fishery (observer coverage based on 5 percent of the total reported sets and 100 percent observer coverage during the NED experimental fishery 2001-2002), there have been no documented interactions between this pelagic longline fishery and offshore large whales. In 2003, however, a baleen whale was incidentally entangled in pelagic longline gear used in the NED experimental fishery. The fishery observer was unable to definitively identify or photograph the animal, so it is not known if it was a listed or unlisted species. However, it is reasonable to believe that this was an ESA-listed species based on the baleen whale species whose range overlaps with the operation of the fishery. The observer was able to document that the animal was released alive with no gear left on the animal. Although the Atlantic Scientific Review Group (ASRG) has not yet made a "serious injury" determination for this event in accordance with the Marine Mammal Protection Act, based on the serious injury determination criteria for marine mammals (Angliss and DeMaster, 1998), the "unidentified" whale was likely unharmed, with no chance of post-release mortality.

Northern right, fin, and humpback whales are more coastal in their distribution, although they can occur in offshore areas as well. We believe that, because of their more coastal distribution, right, fin, and humpback whales are even less likely to interact with the longline fishery than the offshore large whales. There have been no reported or documented interactions between these whales species and the Atlantic pelagic longline fishery. Given their more coastal distribution, it is unlikely that the 2003 unidentified baleen whale was one of these species.

Because Northern right, fin, humpback, blue, sei, and sperm whales occur in the action area, we acknowledge there is a possibility of interaction with the longline fishery. The available evidence indicates interactions are exceedingly rare, and in two of the three known cases, non-injurious. There is only one documented interaction that may have been injurious (a humpback whale that was released with trailing gear), and that was the result of a near-coastal set in the Pacific. Most near-coastal areas are closed to pelagic longline fishing in the Atlantic. We believe the chances of a fin, humpack, Northern right, blue, sei, or sperm whale being adversely affected by the Atlantic pelagic longline fishery in the foreseeable future are discountable. We conclude the proposed action is not likely to adversely affect these species, and these species will not be considered further in this opinion.

3.2.2 Fish

The endangered Gulf of Maine Atlantic salmon distinct population segment (DPS) includes the wild population of Atlantic salmon found in rivers and streams from the lower Kennebec River north to the U.S.-Canada border. These include the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers and Cove Brook. Atlantic salmon are an anadromous species. Spawning and juvenile rearing occur in freshwater rivers followed by migration to the marine environment. Juvenile salmon in New England rivers typically migrate to sea in May after a two to three year period of development in freshwater streams. The salmon remain at sea for two winters before returning to their U.S. natal rivers to spawn from mid October through early November. While at sea, salmon generally undergo extensive migrations in the Northwest Atlantic to waters off Canada and Greenland, thus, they are widely distributed seasonally over much of the region. Captures of wild Atlantic salmon in U.S. commercial fishing or by research/survey operations are rare. There have been a few reported taken by trawls in the Gulf of Maine and southern New England, but there are no records since 1992. An adult salmon caught by a commercial fishing vessel in 2001 was subsequently determined to be an escaped aquaculture fish. Based on this information, it is highly unlikely that the action being considered in this opinion will affect the Gulf of Maine DPS of Atlantic salmon. This species will not be considered further in this opinion.

Smalltooth sawfish historically occurred commonly in the shallow waters of the Gulf of Mexico and along the eastern seaboard as far north as North Carolina, with rare records of occurrence as far north as New York. The smalltooth sawfish range has subsequently contracted to predominantly peninsular Florida and, within that area, they can only be found with any regularity off the extreme southern portion of the state. Smalltooth sawfish are generally shallow warm-water fish, known to spend most of their time at or near the bottom of inshore bars, mangrove edges, and seagrass beds. Younger (smaller) animals are believed to be restricted to shallow depths; however, larger animals roam over a much greater depth range, with records from as deep as over 70 m.

In the 14 years that NOAA Fisheries observers have been collecting data in the Atlantic longline fishery, there have been no documented interactions between the HMS pelagic longline fishery and smalltooth sawfish. The only areas where smalltooth sawfish are likely to occur in the Atlantic EEZ are off the coast of Florida and northern Georgia. Since March 1, 2001, the waters off the east coast of Florida have been closed to HMS pelagic longline fishing year-round, and the Charleston Bump, which encompasses federal waters off of Georgia, is closed seasonally to HMS pelagic longline fishing (see Figure 2.3.1. C). Based on the rarity of smalltooth sawfish in federal waters where HMS pelagic longline fishing occurs, their benthic habits, and the absence of records in observer data, it is highly unlikely that the action being considered in this opinion will affect the smalltooth sawfish. Thus, this species will not be considered further in this opinion.

3.2.3 Northern Right Whale Critical Habitat

Northern right whale critical habitat (50 FR 28793) has been designated in the action area in the following general areas: (1) coastal Florida and Georgia, (2) the Great South Channel, east of Cape Cod, (3) Cape Cod Bay and Massachusetts Bay. The closure of the Florida East Coast area to longline fishing almost totally eliminates the coastal Florida and Georgia critical habitat area from the action area. The remaining critical habitat areas that are not closed to longline fishing are shallow, coastal areas that are not used by the longline fishery (see Figures 2.3.1. A and B). The environmental features (typically referred to as the primary constituent elements) of the critical habitat areas relate to water depth, water temperature, bathymetry, and food availability. Pelagic longline gear, even if used in the critical habitat areas, will have no impact on these features. Thus, the proposed action will not adversely affect the constituent elements of designated critical habitat for the North Atlantic right whale.

3.3 Analysis of the Species Likely to be Adversely Affected

The following subsections are synopses of the current state of knowledge on the life history, distribution, and population trends of sea turtle species which may be affected by the proposed action. Additional background information on the range-wide status of these species can be found in a number of published documents, including: recovery plans for the U.S. population of loggerhead sea turtles (NMFS and USFWS 1991b), Kemp's ridley sea turtle (USFWS and NMFS 1992), green sea turtle (NMFS and USFWS 1991a), hawksbill sea turtle (NMFS and USFWS 1993), and leatherback sea turtle (NMFS and USFWS 1992); Pacific Sea Turtle Recovery Plans (NMFS and USFWS, 1998a-e) and sea turtle status reviews and biological reports (NMFS and USFWS 1995; Marine Turtle Expert Working Group (TEWG) 1998 & 2000, NMFS SEFSC 2001). Further information for olive ridley sea turtles can also be found at: http://www.nmfs.noaa.gov/prot_res/species/turtles/olive.html and http://northflorida.fws.gov/SeaTurtles/Turtle%20Factsheets/olive-ridley-sea-turtle.htm

Green, leatherback, loggerhead, hawksbill, Kemp's ridley, and olive ridley sea turtles are highly migratory or have migratory phases in their life history. As a result, they are exposed to a multitude of fisheries in which they can be caught and injured, as well as other sources of anthropogenic mortality throughout their range, such as vessel traffic. In addition to anthropogenic factors, natural threats to nesting beaches and marine habitats such as coastal erosion, seasonal storms, predators, and temperature variations also affect the survival and recovery of sea turtle populations. As a result, sea turtles still face many of the original threats that were the cause of their listing under the ESA.

These subsections focus primarily on the Atlantic Ocean populations of sea turtle species since these are the populations that may be directly affected by the proposed action. However, because these species are listed as global populations (with the exception of Kemp's ridleys and Florida greens, whose distribution is entirely in the Atlantic), the global status and trends of these species are included to provide a basis and frame of reference for our final determination of the effects of the proposed action on the species as listed under the ESA.

3.4.1 Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. It was listed because of direct take, incidental capture in various fisheries, and the alteration and destruction of its habitat. Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic Ocean, Pacific Ocean, Indian Ocean, Caribbean Sea and Mediterranean Sea. In the Atlantic, developmental habitat for small juveniles is the pelagic waters of the North Atlantic and the Mediterranean Sea (NMFS and USFWS 1991b). Within the continental United States, loggerhead sea turtles nest from Texas to New Jersey. Major nesting areas include coastal islands of Georgia, South Carolina, and North Carolina, and the Atlantic and Gulf coasts of Florida, with the bulk of the nesting occurring on the Atlantic coast of Florida.

3.4.1.1 Pacific Ocean

In the Pacific Ocean, major loggerhead nesting grounds are generally located in temperate and subtropical regions with scattered nesting in the tropics. Within the Pacific Ocean, loggerhead sea turtles are represented by a northwestern Pacific nesting aggregation (located in Japan) and a smaller southwestern nesting aggregation that occurs in eastern Australia (Great Barrier Reef and Queensland) and New Caledonia (NMFS SEFSC 2001). There are no reported loggerhead nesting sites in the eastern or central Pacific Ocean basin. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead turtles (Bolten et al. 1996). However, loggerhead nesting populations in Japan have declined 50-90% in the last 50 years (N. Kamezaki, Sea Turtle Association of Japan, personal communication, August, 2001). Recent genetic analyses on female loggerheads nesting in Japan suggest that this "subpopulation" is comprised of genetically distinct nesting colonies (Hatase et al., 2002) with precise natal homing of individual females. As a result, Hatase et al. (2002) indicate that loss of one of these colonies would decrease the genetic diversity of Japanese loggerheads; recolonization of the site would not be expected on an ecological time scale. In Australia, long-term census data has been collected at some rookeries since the late 1960s and early 1970s, and nearly all the data show marked declines in nesting populations since the mid-1980s (Limpus and Limpus, 2003). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

Pacific loggerhead turtles are captured, injured, or killed in numerous Pacific fisheries including Japanese longline fisheries in the western Pacific Ocean and South China Seas; direct harvest and commercial fisheries off Baja California, Mexico; commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet fisheries. In addition, the abundance of loggerhead turtles on nesting colonies throughout the Pacific basin has declined dramatically over the past 10 to 20 years. Loggerhead turtle colonies in the western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females and reduced the reproductive success of females that manage to nest (e.g., due to egg poaching).

3.4.1.2 Atlantic Ocean

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. There are at least five western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29º N; (2) a south Florida nesting subpopulation, occurring from 29ºN on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez 1990 and TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS SEFSC 2001). The fidelity of nesting females to their nesting beach is the reason these subpopulations can be differentiated from one another. This nest beach fidelity will make recolonization of nesting beaches with sea turtles from other subpopulations unlikely.

Life history and Distribution
Past literature gave an estimated age at maturity of 21-35 years (Frazer and Ehrhart 1985, Frazer et al. 1994) with the benthic immature stage lasting at least 10-25 years. However, based on new data from tag returns, strandings, and nesting surveys NMFS SEFSC (2001) estimated ages of maturity ranging from 20-38 years and benthic immature stage lasting from 14-32 years.

Mating takes place in late March-early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern United States. Individual females nest multiple times during a nesting season, with a mean of 4.1 nests/individual (Murphy and Hopkins 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2-3 years, but can vary from 1-7 years (Dodd 1988). Generally, 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 or more. Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U. S. Atlantic and Gulf of Mexico, although some loggerheads may move back and forth between the pelagic and benthic environment (Witzell 2002). Benthic immature loggerheads (sea turtles that have come back to inshore and nearshore waters), the life stage following the pelagic immature stage, have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in Northeastern Mexico. Tagging studies have shown loggerheads which have entered the benthic environment undertake routine migrations along the coast that are limited by seasonal water temperatures. Within the action area of this consultation, loggerhead sea turtles occur year round in offshore waters off of North Carolina where water temperature is influenced by the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to immigrate to North Carolina inshore waters (e.g., Pamlico and Core Sounds) and also move up the coast (Epperly et al. 1995c; Epperly et al. 1995 a; Epperly et al. 1995b), occurring in Virginia foraging areas as early as April and on the most northern foraging grounds in the Gulf of Maine in June. The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by mid-September but some may remain in Mid-Atlantic and Northeast areas until late Fall. By December loggerheads have emigrated from inshore North Carolina waters and coastal waters to the north to waters offshore of North Carolina, particularly off of Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles (11° C) (Epperly et al. 1995c; Epperly et al. 1995a; Epperly et al. 1995b). Loggerhead sea turtles are year-round residents of central and south Florida.

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd 1988). Sub-adult and adult loggerheads are primarily coastal and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

Population Dynamics and Status
A number of stock assessments (TEWG 1998, TEWG 2000, NMFS SEFSC 2001, Heppell et al. 2003) have examined the stock status of loggerheads in the waters of the United States, but have been unable to develop any reliable estimates of absolute population size. Based on nesting data of the five western Atlantic subpopulations, the south Florida-nesting and the northern-nesting subpopulations are the most abundant (TEWG 2000 and NMFS SEFSC 2001). 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 (TEWG 2000). On average, 90.7% of these nests were of the south Florida subpopulation and 8.5% were from the northern subpopulation (TEWG 2000). The Turtle Expert Working Group's (TEWG) (2000) assessment of the status of these two better-studied populations concluded that the south Florida subpopulation is increasing, while no trend is evident (maybe stable but possibly declining) for the northern subpopulation. However, more recent analysis, including nesting data through 2003, indicate that there is no discernable trend in the south Florida nesting subpopulation (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide and Index Nesting Beach Survey Programs). Another consideration that may add to the importance and vulnerability of the northern subpopulation is the sex ratios of this subpopulation. NOAA Fisheries' scientists have estimated that the northern subpopulation produces 65 percent males (NMFS SEFSC 2001). However, new research conducted over a limited time-frame has found sex ratios opposite to this (Wyneken et al. 2004), and so further information is needed to clarify the issue. Since nesting female loggerhead sea turtles exhibit nest fidelity, the continued existence of the northern subpopulation is related to the number of female hatchlings that are produced. Producing fewer females will limit the number of subsequent offspring produced by the subpopulation.

The remaining three subpopulations (the Dry Tortugas, Florida Panhandle, and Yucatán) are much smaller subpopulations but no less relevant to the continued existence of the species. Nesting surveys for the Dry Tortugas subpopulation are conducted as part of Florida's statewide survey program. Survey effort has been relatively stable during the 9-year period from 1995-2003 (although the 2002 year was missed). Nest counts ranged from 168-270 but with no detectable trend during this period (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide Nesting Beach Survey Data). Nest counts for the Florida Panhandle subpopulation are focused on index beaches rather than all beaches where nesting occurs. Currently, there is not enough information to detect a trend for the subpopulation (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Index Nesting Beach Survey Database). Similarly, nesting survey effort has been inconsistent among the Yucatán nesting beaches and no trend can be determined for this subpopulation. However, there is some optimistic news. Zurita et al. (2003) found a statistically significant increase in the number of nests on seven of the beaches on Quintana Roo, Mexico from 1987-2001 where survey effort was consistent during the period.

Threats
The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the benthic environment, and in the pelagic environment. Hurricanes are particularly destructive to sea turtle nests. Sand accretion and rainfall that result from these storms as well as wave action can appreciably reduce hatchling success. For example, in 1992, all of the eggs over a 90-mile length of coastal Florida were destroyed by storm surges on beaches that were closest to the eye of Hurricane Andrew (Milton et al. 1994). Other sources of natural mortality include cold stunning and biotoxin exposure.

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

Loggerhead sea turtles are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration; coastal development, and transportation; marine pollution; underwater explosions; hopper dredging, offshore artificial lighting; power plant entrainment and/or impingement; entanglement in debris; ingestion of marine debris; marina and dock construction and operation; boat collisions; poaching; and fishery interactions. In the pelagic environment loggerheads are exposed to a series of longline fisheries that include the HMS pelagic longline fisheries, an Azorean longline fleet, a Spanish longline fleet, and various fleets in the Mediterranean Sea (Aguilar et al. 1995; Bolten et al. 1994; Crouse 1999b). In the benthic environment in waters off the coastal U.S., loggerheads are exposed to a suite of fisheries in federal and state waters including trawl, purse seine, hook and line, gillnet, pound net, longline, and trap fisheries (see further discussion in the Environmental Baseline of this opinion).

3.4.1.3 Summary of Status for Loggerhead Sea Turtles

In the Pacific Ocean, loggerhead turtles are represented by a northwestern Pacific nesting aggregation (located in Japan) and a smaller southwestern nesting aggregation that occurs in Australia (Great Barrier Reef and Queensland) and New Caledonia. The abundance of loggerhead turtles on nesting colonies throughout the Pacific basin have declined dramatically over the past 10 to 20 years. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead turtles (Bolten et al. 1996), but it has probably declined since 1995 and continues to decline (Tillman 2000). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

In the Atlantic Ocean, absolute population size is not known, but based on nesting information, loggerheads are likely much more numerous than in the Pacific Ocean. NOAA Fisheries recognizes five subpopulations of loggerhead sea turtles in the western north Atlantic based on genetic studies. Cohorts from all of these are known to occur within the action area of this consultation. There are no detectable nesting trends for the two largest western Atlantic subpopulations: the South Florida subpopulation and the northern subpopulation. Because of its size, the South Florida subpopulation may be critical to the survival of the species in the Atlantic Ocean. In the past, this nesting aggregation was considered second in size only to the nesting aggregation on islands in the Arabian Sea off Oman (Ross 1979, Ehrhart 1989, NMFS and USFWS 1991b). However, the status of the Oman colony has not been evaluated recently and it is located in an area of the world where it is highly vulnerable to disruptive events such as political upheavals, wars, catastrophic oil spills, and lack of strong protections for sea turtles (Meylan et al. 1995). Given the lack of updated information on this population, the status of loggerheads in the Indian Ocean basin overall is essentially unknown.

All loggerhead subpopulations are faced with a multitude of natural and anthropogenic effects that negatively influence the status of the species. Many anthropogenic effects occur as a result of activities outside of U.S. jurisdiction (i.e., fisheries in international waters).

3.4.2 Green Sea Turtle

Federal listing of the green sea turtle occurred on July 28, 1978, with all populations listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are endangered. The complete nesting range of the green sea turtle is located within NOAA

Fisheries' Southeast Region and includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands between Texas and North Carolina and the U. S. Virgin Islands (U.S.V.I.) and Puerto Rico (NMFS and USFWS 1991a). Principal U. S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard through Broward counties (Ehrhart and Witherington 1992). Green sea turtle nesting also occurs regularly on St. Croix, U.S.V.I., and on Vieques, Culebra, Mona, and the main island of Puerto Rico (Mackay and Rebholz 1996).

3.4.2.1 Pacific Ocean

Green turtles are thought to be declining throughout the Pacific Ocean, with the exception of Hawaii, from a combination of overexploitation and habitat loss (Eckert 1993, Seminoff 2002). In the western Pacific, the only major (>2,000 nesting females) populations of green turtles occur in Australia and Malaysia, with smaller colonies throughout the area. Indonesia has a widespread distribution of green turtles, but has experienced large declines over the past 50 years. The Hawaii green turtles are genetically distinct and geographically isolated, and the population appears to be increasing in size despite the prevalence of fibropapilloma and spirochidiasis (Aguirre et al. 1998 in Balazs and Chaloupka, in press). In the Eastern Pacific, mitochondrial DNA analysis has indicated that there are three key nesting populations: Michoacan, Mexico; Galapagos Islands, Ecuador; and Islas Revillagigedos, Mexico (Dutton 2003). There is also sporadic green turtle nesting along the Pacific coast of Costa Rica.

3.4.2.2 Atlantic Ocean

Life history and Distribution
The estimated age at sexual maturity for green sea turtles is between 20-50 years (Balazs 1982, Frazer and Ehrhart 1985). Green sea turtle mating occurs in the waters off the nesting beaches. Each female deposits 1-7 clutches (usually 2-3) during the breeding season at 12-14 day intervals. Mean clutch size is highly variable among populations, but averages 110-115 eggs/nest. Females usually have 2-4 or more years between breeding seasons, whereas males may mate every year (Balazs 1983). After hatching, green sea turtles go through a post-hatchling pelagic stage where they are associated with drift lines of algae and other debris. At approximately 20 to 25 cm carapace length, juveniles leave pelagic habitats and enter benthic foraging areas (Bjorndal 1997).

Green sea turtles are primarily herbivorous, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The post-hatchling, pelagic-stage individuals are assumed to be omnivorous, but little data are available.

Green sea turtle foraging areas in the southeastern United States include any coastal shallow waters having macroalgae or sea grasses. This includes areas near mainland coastlines, islands, reefs, or shelves, and any open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (Hirth 1997; NMFS and USFWS 1991a). Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty 1984; Hildebrand 1982; Shaver 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957; Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon System, Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward counties (Wershoven and Wershoven 1992; Guseman and Ehrhart 1992). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs.

Population Dynamics and Status
The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Meylan et al. 1995, Johnson and Ehrhart 1994). It is known that current nesting levels in Florida are reduced compared to historical levels, but the extent of the reduction is not known (Dodd 1981). However, green sea turtle nesting in Florida has been increasing since 1989 (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute Index Nesting Beach Survey Database). Total nest counts and trends at index beach sites during the past decade suggest the numbers of green sea turtles that nest within the southeastern United States are increasing.

Although nesting activity is obviously important in determining population distributions, the remaining portion of the green turtle's life is spent on the foraging and breeding grounds. Some of the principal feeding pastures in the western Atlantic Ocean include the upper west coast of Florida and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean Coast of Panama, and scattered areas along Colombia and Brazil (Hirth 1971). The summer developmental habitat for green turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus 1997).

There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas (where they come to forage) of the southeastern United States. However, information on incidental captures of immature green sea turtles at the St. Lucie Power Plant (they have averaged 215 green sea turtle captures per year since 1977) in St. Lucie County, Florida (on the Atlantic coast of Florida) show that the annual number of immature green sea turtles captured has increased significantly in the past 26 years (FPL 2002).

It is likely that immature green sea turtles foraging in the southeastern United States come from multiple genetic stocks; therefore, the status of immature green sea turtles in the southeastern United States might also be assessed from trends at all of the main regional nesting beaches, principally Florida, Yucatán, and Tortuguero. Trends at Florida beaches were previously discussed. Trends in nesting at Yucatán beaches cannot be assessed because of a lack of consistent beach surveys over time. Trends at Tortuguero (ca. 20,000-50,000 nests/year) showed a significant increase in nesting during the period 1971-1996 (Bjorndal et al. 1999), and more recent information continues to show increasing nest counts (Schroeder pers. comm.). Therefore, it seems reasonable that there is an increase in immature green sea turtles inhabiting coastal areas of the southeastern United States; however, the magnitude of this increase is unknown.

Threats
The principal cause of past declines and extirpations of green sea turtle assemblages has been the over-exploitation of green sea turtles for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U. S. jurisdiction, where exploitation is still a threat. However, there are still significant and ongoing threats to green sea turtles from human-related causes in the United States. These threats include beach armoring, erosion control, artificial lighting, beach disturbance (e.g., driving on the beach), pollution, foraging habitat loss as a result of direct destruction by dredging, siltation, boat damage, other human activities, and interactions with fishing gear. Sea sampling coverage in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles. There is also the increasing threat from green sea turtle fibropapillomatosis disease. Presently, this disease is cosmopolitan and has been found to affect large numbers of animals in some areas, including Hawaii and Florida (Herbst 1994, Jacobson 1990, Jacobson et al. 1991).

3.4.2.3 Summary of Status for Atlantic Green Sea Turtles

Green turtles range in the western Atlantic from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean, but are considered rare in benthic areas north of Cape Hatteras (Wynne and Schwartz 1999). Green turtles face many of the same natural and anthropogenic threats as for loggerhead sea turtles described above. In addition, green turtles are also susceptible to fibropapillomatosis which can result in death. In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart 1979). Recent population estimates for the western Atlantic area are not available. However, 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 index beaches in 1989. However, given the species' late sexual maturity, caution is warranted about over interpreting nesting trend data collected for less than 15 years.

3.4.3 Kemp's Ridley Sea Turtle

The Kemp's ridley was listed as endangered on December 2, 1970. Internationally, the Kemp's ridley is considered the most endangered sea turtle (Zwinenberg 1977; Groombridge 1982; TEWG 2000). Kemp's ridleys nest primarily at Rancho Nuevo, a stretch of beach in Mexico, Tamaulipas State. The species occurs mainly in coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean. Occasional individuals reach European waters (Brongersma 1972). Adults of this species are usually confined to the Gulf of Mexico, although adult-sized individuals sometimes are found on the east coast of the United States. This species occurs only in the Atlantic Ocean.

Life history and Distribution

The TEWG (1998) estimates age at maturity from 7-15 years. Females return to their nesting beach about every 2 years (TEWG 1998). Nesting occurs from April into July and is essentially limited to the beaches of the western Gulf of Mexico, near Rancho Nuevo in southern Tamaulipas, Mexico. The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season.

Little is known of the movements of the post-hatching stage (pelagic stage) within the Gulf. Studies have shown the post-hatchling pelagic stage varies from 1-4 or more years, and the benthic immature stage lasts 7-9 years (Schmid and Witzell 1997). Benthic immature Kemp's ridleys have been found along the east coast seaboard of the United States and in the Gulf of Mexico. Atlantic benthic immature sea turtles travel northward as the water warms to feed in the productive, coastal waters off Georgia through New England, returning southward with the onset of winter (Lutcavage and Musick 1985, Henwood and Ogren 1987, Ogren 1989). Studies suggest that benthic immature 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 1995).

Stomach contents of Kemp's ridleys along the lower Texas coast consisted of nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards (Shaver 1991). Pelagic stage Kemp's ridleys presumably feed on the available sargassum and associated infauna or other epipelagic species found in the Gulf of Mexico.

Population Dynamics and Status

Of the seven extant species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the Rancho Nuevo beaches (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 mid-1980s nesting numbers were below 1,000 (with a low of 702 nests in 1985). However, observations of increased nesting (with 6,277 nests recorded in 2000) suggest that the decline in the ridley population has stopped and the population is now increasing (USFWS 2000).

A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles beginning in 1990. The increased survivorship of immature sea turtles is attributable, in part, to the introduction of turtle excluder devices (TEDs) in the United States and Mexican shrimping fleets. As demonstrated by nesting increases at the main nesting sites in Mexico, adult ridley numbers have increased over the last decade. The population model used by

TEWG (2000) projected that Kemp's ridleys could reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015.

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

Threats

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

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

Summary of Kemp's ridley Status

The only major nesting site for ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963). The number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3% per year from 1985 to 1999. Current totals exceed 3,000 nests per year (TEWG 2000). Kemp's ridleys mature at an earlier age (7 - 15 years) than other chelonids, thus 'lag effects' as a result of unknown impacts to the non-breeding life stages would likely have been seen in the increasing nest trend beginning in 1985 (USFWS and NMFS 1992).

The largest contributors to the decline of Kemp's ridleys in the past were commercial and local exploitation, especially poaching of nests at the Rancho Nuevo site, as well as the Gulf of Mexico trawl fisheries. The advent of TED regulations for trawlers and protections for the nesting beaches have allowed the species to begin to rebound. Many threats to the future of the species remain, including interactions with fishery gear, marine pollution, foraging habitat destruction, illegal poaching of nests and potential threats to the nesting beaches from such sources as global climate change, development, and tourism pressures.

3.4.4 Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its global range on June 2, 1970. Leatherbacks are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, and Indian oceans; the Caribbean Sea; and the Gulf of Mexico (Ernst and Barbour 1972). Leatherback sea turtles are the largest living turtles and range farther than any other sea turtle species. Their large size and their tolerance of relatively low temperatures allows them to occur in northern waters such as off Labrador and in the Barents Sea (NMFS and USFWS 1995). 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 their tropical nesting beaches. In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982). That number, however, is probably an overestimation as it was based on a particularly good nesting year in 1980 (Pritchard 1996). By 1995, this global population of adult females had declined to 34,500 (Spotila et al. 1996). Pritchard (1996) also called into question the population estimates from Spotila et al. (1996), and felt it may be somewhat low, because it ended the modeling on data from a particularly bad nesting year (1994) while excluding nesting data from 1995, which was a good nesting year. However, at this time, Spotila et al. (1996) represents the best overall estimate of adult female leatherback population size.

3.4.4.1 Pacific Ocean.

Based on published estimates of nesting female abundance, leatherback populations have collapsed or have been declining at all major Pacific basin nesting beaches for the last two decades (Spotila et al. 1996; NMFS and USFWS 1998c; Sarti et al. 2000; Spotila et al. 2000). For example, the nesting assemblage on Terengganu, Malaysia – which was one of the most significant nesting sites in the western Pacific Ocean – has declined severely from an estimated 3,103 females in 1968 to 2 nesting females in 1994 (Chan and Liew 1996). Nesting assemblages of leatherback turtles are in decline along the coasts of the Solomon Islands; a historically important nesting area (D. Broderick, pers. comm., in Dutton et al. 1999). In Fiji, Thailand, Australia, and Papua New Guinea (East Papua), leatherback turtles have only been known to nest in low densities and scattered colonies.

Only an Indonesian nesting assemblage has remained relatively abundant in the Pacific basin. The largest extant leatherback nesting assemblage in the Indo-Pacific lies on the north Vogelkop coast of Irian Jaya (West Papua), Indonesia, with over 3,000 nests recorded annually (Putrawidjaja 2000; Suarez et al. 2000). During the early-to-mid 1980s, the number of female leatherback turtles nesting on the two primary beaches of Irian Jaya appeared to be stable. More recently, this population has come under increasing threats that could cause this population to experience a collapse that is similar to what occurred at Terengganu, Malaysia. In 1999, for example, local Indonesian villagers started reporting dramatic declines in sea turtle populations near their villages (Suarez 1999). Unless hatchling and adult turtles on nesting beaches receive more protection, this population will continue to decline. Declines in nesting assemblages of leatherback turtles have been reported throughout the western Pacific region, with nesting assemblages well below abundance levels observed several decades ago (e.g., Suarez 1999).

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

In the eastern Pacific Ocean, nesting populations of leatherback turtles are declining along the Pacific coast of Mexico and Costa Rica. According to reports from the late 1970s and early 1980s, three beaches on the Pacific coast of Mexico supported as many as half of all leatherback turtle nests for the eastern Pacific. Since the early 1980s, the eastern Pacific Mexican population of adult female leatherback turtles has declined to slightly more than 200 individuals during 1998-99 and 1999-2000 (Sarti et al. 2000). Spotila et al. (2000) reported the decline of the leatherback turtle population at Playa Grande, Costa Rica, which had been the fourth largest nesting colony in the world. Between 1988 and 1999, the nesting colony declined from 1,367 to 117 female leatherback turtles. Based on their models, Spotila et al. (2000) estimated that the colony could fall to less than 50 females by 2003-2004. Leatherback turtles in the eastern Pacific Ocean are captured, injured, or killed in commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet fisheries. Because of the limited data, we cannot provide high-certainty estimates of the number of leatherback turtles captured, injured, or killed through interactions with these fisheries. However, between 8 and 17 leatherback turtles were estimated to have died annually between 1990 and 2000 in interactions with the California/Oregon drift gillnet fishery; 500 leatherback turtles are estimated to die annually in Chilean and Peruvian fisheries; 200 leatherback turtles are estimated to die in direct harvests in Indonesia; and before 1992, the North Pacific driftnet fisheries for squid, tuna, and billfish captured an estimated 1,000 leatherback turtles each year, killing about 111 of them each year.

Although all causes of the declines in leatherback turtle colonies in the eastern Pacific have not been documented, Sarti et al. (1998) suggest that the declines result from egg poaching, adult and sub-adult mortalities incidental to high seas fisheries, and natural fluctuations due to changing environmental conditions. Some published reports support this suggestion. Sarti et al. (2000) reported that female leatherback turtles have been killed for meat on nesting beaches like Píedra de Tiacoyunque, Guerrero, Mexico. Eckert (1997) reported that swordfish gillnet fisheries in Peru and Chile contributed to the decline of leatherback turtles in the eastern Pacific. The decline in the nesting population at Mexiquillo, Mexico occurred at the same time that effort doubled in the Chilean driftnet fishery. In response to these effects, the eastern Pacific population has continued to decline, leading some researchers to conclude that the leatherback is on the verge of extinction in the Pacific Ocean (e.g., Spotila et al. 1996; Spotila et al. 2000). NOAA Fisheries' assessment of three nesting aggregations in its February 23, 2004, opinion supports this conclusion: if no action is taken to reverse their decline, leatherback sea turtles nesting in the Pacific Ocean either have high risks of extinction in a single human generation (for example, nesting aggregations at Terrenganu and Costa Rica) or they have a high risk of declining to levels where more precipitous declines become almost certain (for example Irian Jaya) (NOAA Fisheries 2004).

3.4.4.2 Atlantic Ocean.

In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS SEFSC 2001). Female leatherbacks nest from the 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 Suriname (NMFS SEFSC 2001). Genetic analyses of leatherbacks to date indicate that within the Atlantic basin there are genetically different nesting populations; the St. Croix nesting population (U.S. Virgin Islands), the mainland nesting Caribbean population (Florida, Costa Rica, Suriname/French Guiana) and the Trinidad nesting population (Dutton et al. 1999). When the hatchlings leave the nesting beaches, they move offshore but eventually utilize both coastal and pelagic waters. Very little is known about the pelagic habits of the hatchlings and juveniles, and they have not been documented to be associated with the sargassum areas as are other species. Leatherbacks are deep divers, with recorded dives to depths in excess of 1,000 m (Eckert et al. 1989; Hayes et al. 2004).

Life History and Distribution
Leatherbacks are a long-lived species, living for over 30 years. They reach sexual maturity somewhat faster than other sea turtles(except Kemp's ridley), with an estimated range from 3-6 years (Rhodin 1985) to 13-14 years (Zug and Parham 1996). They nest frequently (up to10 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). However, a significant portion (up to approximately 30%) of the eggs can be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this

seasonal estimate. The eggs will incubate for 55-75 days before hatching. Based on a review of all sightings of leatherback sea turtles of <145 cm curved carapace length (ccl), Eckert (1999) found that leatherback juveniles remain in waters warmer than 26°C until they exceed 100 cm ccl.

Leatherbacks are the most pelagic of the sea turtles, but enter coastal waters on a seasonal basis to feed in areas where jellyfish are concentrated. Leatherback sea turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates.

Evidence from tag returns and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between boreal, temperate and tropical waters (NMFS and USFWS 1992). A 1979 aerial survey of the outer Continental Shelf from Cape Hatteras, North Carolina to Cape Sable, Nova Scotia showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Leatherbacks were sighted in waters where depths ranged from 1-4151 m, but 84.4% of sightings were in areas where the water was less than 180 m deep (Shoop and Kenney 1992). Leatherbacks were sighted in waters of a similar sea surface temperature as loggerheads; from 7-27.2 ° C (Shoop and Kenney 1992). However, this species appears to have a greater tolerance for colder waters because more leatherbacks were found at the lower temperatures (Shoop and Kenney 1992). This aerial survey estimated the in-water leatherback population from near Nova Scotia, Canada to Cape Hatteras, North Carolina at approximately 300-600 animals.

Population Dynamics and Status

The status of the Atlantic leatherback population is less clear than the Pacific population. The total Atlantic population size is undoubtedly larger than in the Pacific, but overall population trends are unclear. In 1996, the entire western Atlantic population was characterized as stable at best (Spotila et al. 1996), with numbers of nesting females reported to be on the order of 18,800. A subsequent analysis by Spotila (pers. comm.) indicated that by 2000, the western Atlantic nesting population had decreased to about 15,000 nesting females. According to NMFS SEFSC (2001) the nesting aggregation in French Guiana has been declining at about 15 percent per year since 1987. However, from 1979-1986, the number of nests was increasing at about 15 percent annually which could mean that the current 15 percent decline could be part of a nesting cycle which coincides with the erosion cycle of Guiana beaches described by Schultz (1975). In Suriname, leatherback nest numbers have shown large recent increases (with more than 10,000 nests per year since 1999 and a peak of 30,000 nests in 2001), and the long-term trend for the overall Suriname and French Guiana population may show an increase (Girondot 2002 in Hilterman and Goverse 2003). The number of nests in Florida and the U.S. Caribbean has been increasing at about 10.3 percent and 7.5 percent, respectively, per year since the early 1980s but the magnitude of nesting is much smaller than that along the French Guiana coast (NMFS SEFSC 2001). Also, because leatherback females can lay 10 nests per season, the recent increases to 400 nests per year in Florida may only represent as few as 40 individual female nesters per year.

In summary, the conflicting information regarding the status of Atlantic leatherbacks makes it difficult to characterize the current status. Numbers at some nesting sites are increasing, but are decreasing at other sites. Tag return data emphasize the wide-ranging nature of the leatherback and the link between 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, Virginia. Another nester tagged in French Guiana on June 21, 1990, was later found dead in Palm Beach, Florida (STSSN database). Genetic studies performed within the NED indicate that the leatherbacks captured in the HMS pelagic longline fishery were primarily from the French Guiana and Trinidad nesting stocks (over 95%), though individuals from West African stocks were surprisingly absent (Roden et al. In press).

There are a number of problems contributing to the uncertainty of the leatherback nest counts and population assessments. The nesting beaches of the Guianas (Guyana, French Guiana, and Suriname) and Trinidad are by far the most important in the western Atlantic. However, beaches in this region undergo cycles of erosion and reformation, so that the nesting beaches are not consistent over time. Additionally, leatherback sea turtles do not exhibit the same degree of nest-site fidelity demonstrated by loggerhead and other hardshell sea turtles, further confounding analysis of population trends using nesting data. Reported declines in one country and reported increases in another may be the result of migration and beach changes, not true population changes. Nesting surveys, as well as being hampered by the inconsistency of the nesting beaches, are themselves inconsistent throughout the region. Survey effort varies widely in the seasonal coverage, areal coverage, and actual surveyed sites. Surveys have not been conducted consistently throughout time, or have even been dropped entirely as the result of wars, political turmoil, funding vagaries, etc. The methods vary in assessing total numbers of nests and total numbers of females. Many sea turtle scientists agree that the Guianas (and some would include Trinidad) should be viewed as one population and that a synoptic evaluation of nesting at all beaches in the region is necessary to develop a true picture of population status (Reichart 2001). No such region-wide assessment has been conducted recently. The most recent, complete estimates of regional leatherback populations are in Spotila et al. (1996). As discussed above, nesting in the Guianas may have been declining in the late 1990s but may have increased again in the early 2000s. Spotila et al. estimated that the leatherback population for the Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa totaled approximately 27,600 nesting females, with an estimated range of 20,082-35,133. We believe that the current population probably still lies within this range, taking into account the reported nesting declines and increases and the uncertainty surrounding them. We therefore choose to rely on Spotila et al.'s (1996) published total Atlantic population estimates, rather than attempt to construct a new population estimate here, based on our interpretation of the various, confusing nesting reports from areas within the region.

Threats

Zug and Parham (1996) pointed out that the main threat to leatherback populations in the Atlantic is the combination of fishery-related mortality (especially entanglement in gear and drowning in trawls) and the intense egg harvesting on the main nesting beaches. Other important ongoing threats to the population include pollution, loss of nesting habitat, and boat strikes.

Of the turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, possibly their method of locomotion, and perhaps to the lightsticks used to attract target species in longline fisheries. They are also susceptible to entanglement in gillnets and pot/trap lines (used in various fisheries) and capture in trawl gear (e.g., shrimp trawls).

Leatherbacks are exposed to pelagic longline fisheries in many areas of their range. Unlike loggerhead turtle interactions with longline gear, leatherback turtles do not usually ingest longline bait. Instead, leatherbacks are foul hooked by longline gear (e.g., on the flipper or shoulder area) rather than mouth hooked or swallowing the hook. 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). The U.S. fleet accounts for only 5-8% of the hooks fished in the Atlantic Ocean, and adding up the under-represented observed takes of the other 23 countries that actively fish in the area would lead to annual take estimates of thousands of leatherbacks over different life stages. Basin-wide, Lewison et al. (2004) estimated that 30,000 - 60,000 leatherback sea turtle captures occurred in Atlantic pelagic longline fisheries in the year 2000 alone (note that multiple captures of the same individual are known to occur, so the actual number of individuals captured may not be as high).

Leatherbacks are also susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer et al. 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer et al. 2002). Fixed gear fisheries in the Mid-Atlantic have also contributed to leatherback entanglements. In North Carolina, two leatherback sea turtles were reported entangled in a crab pot buoy inside Hatteras Inlet (D. Fletcher, pers. comm. to S. Epperly). A third leatherback was reported entangled in a crab pot buoy in Pamlico Sound near Ocracoke. This turtle was disentangled and released alive; however, lacerations on the front flippers from the lines were evident (D. Fletcher, pers. comm. to S. Epperly). In the Southeast, leatherbacks are vulnerable to entanglement in Florida's lobster pot and stone crab fisheries. In the U.S. Virgin Islands, where one of five leatherback strandings from 1982 to 1997 was due to entanglement (Boulon 2000), leatherbacks have been observed with their flippers wrapped in the line of West Indian fish traps (R. Boulon, pers. comm. to J. Braun-McNeill). Because many entanglements of this typically pelagic species likely go unnoticed, entanglements in fishing gear may be much higher.

Leatherback interactions with the southeast Atlantic shrimp fishery, which operates predominately from North Carolina through southeast Florida (NOAA Fisheries 2002), have also been a common occurrence. Leatherbacks, which migrate north annually, are likely to encounter shrimp trawls working in the coastal waters off the Atlantic coast from Cape Canaveral, Florida to the Virginia/North Carolina border. For many years, TEDs that were required for use in the southeast shrimp fishery were less effective at excluding leatherbacks than the smaller, hard-shelled turtle species. To address this problem, on February 21, 2003, NOAA Fisheries issued a final rule to amend the TED regulations. Modifications to the design of TEDs are now required in order to exclude leatherbacks and large and sexually mature loggerhead and green turtles. Other trawl fisheries are also known to interact with leatherback sea turtles. In October 2001, a Northeast Fisheries Science Center observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off of Delaware; TEDs are not required in this fishery. The winter trawl flounder fishery, which did not come under the revised TED regulations, may also interact with leatherback sea turtles.

Gillnet fisheries operating in the nearshore waters of the Mid-Atlantic states are also suspected of capturing, injuring, and/or killing leatherbacks when these fisheries and leatherbacks co-occur. Data collected by the NEFSC Fisheries Observer Program from 1994 through 1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 54% to 92%.

Poaching is not known to be a problem for nesting populations in the continental U.S. However, the NMFS SEFSC (2001) notes that poaching of juveniles and adults is still occurring in the U.S. Virgin Islands and the Guianas. In all, 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.

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 that 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 in leatherbacks.

It is important to note that, like marine debris, fishing gear interactions and poaching are problems for leatherbacks throughout their range. Entanglements are common in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line and crab pot line. Leatherbacks are reported taken by many other nations that participate in Atlantic pelagic longline fisheries, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, U.K., Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland (see NMFS SEFSC 2001, for a description of take records). Leatherbacks are known to drown in fish nets set in coastal waters of Sao Tome, West Africa (Castroviejo et al. 1994; Graff 1995). Gillnets are one of the suspected causes for the decline in the leatherback sea turtle population in French Guiana (Chevalier et al. 1999), and gillnets targeting green and hawksbill turtles in the waters of coastal Nicaragua also incidentally catch leatherback turtles (Lagueux et al. 1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio 2000). An estimated 1,000 mature female leatherback sea turtles are caught annually in fishing nets off of Trinidad and Tobago with mortality estimated to be between 50-95% (Eckert and Lien 1999). However, many of the 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).

3.4.4.3 Summary of Leatherback Status

In the Pacific Ocean, the abundance of leatherback turtle nesting individuals and colonies has declined dramatically over the past 10 to 20 years. Nesting colonies throughout the eastern and western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females. In addition, egg poaching has reduced the reproductive success of the remaining nesting females. At current rates of decline, leatherback turtles in the Pacific basin are a critically endangered species with a low probability of surviving and recovering in the wild.

In the Atlantic Ocean, our understanding of the status and trends of leatherback turtles is much more confounded, although the picture does not appear nearly as bleak as in the Pacific. The number of female leatherbacks reported at some nesting sites in the Atlantic Ocean has increased, while at others they have decreased. Some of the same factors that led to precipitous declines of leatherbacks in the Pacific also affect leatherbacks in the Atlantic: leatherbacks are captured and killed in many kinds of fishing gear and interact with fisheries in state, federal and international waters. Poaching is a problem and affects leatherbacks that occur in U.S. waters. Leatherbacks also appear to be more susceptible to death or injury from ingesting marine debris than other turtle species.

3.4.5 Olive Ridley Sea Turtle

The olive ridley sea turtle was listed on July 28, 1978, with all breeding populations listed as threatened except for the Pacific coast of Mexico population which is endangered. There have also been recommendations that the western Atlantic olive ridley populations be reclassified as endangered (Reichart 1993). The olive ridley is a small, hard-shelled sea turtle with an olive-colored shell. It typically occurs within the tropical regions of the Pacific, Atlantic, and Indian Oceans. This species does not nest in the United States, but during feeding migrations, olive ridley turtles nesting in the Pacific may disperse into waters of the southwestern U.S., occasionally as far north as Oregon.

The olive ridley is most noted for its massive nesting aggregations, known as arribadas, with thousands of females nesting in large simultaneous waves over small stretches of beach. Arribadas may be precipitated by climatic events, such as a strong offshore wind, or by certain phases of the moon and tide; however, there is a major element of unpredictability regarding the trigger and timing at all arribada sites. Although not every adult female participates in these arribadas, the vast majority do.

3.4.5.1 Pacific Ocean.

In the eastern Pacific, olive ridleys nest primarily on beaches from Mexico south to at least Colombia (NMFS and USFWS 1995) with major nesting beaches at Escobilla, Mexico; La Flor, Nicaragua; and Ostional and Nancite, Costa Rica. Declines in nesting have been documented for Playa Nancite, Costa Rica. However, other nesting populations along the Pacific coast of Mexico and Costa Rica appear stable or increasing (NMFS 2004). When not at the nesting areas, adult olive ridleys are generally found in warm waters from Baja California, Mexico to Chile (Silva-Batiz et al. 1996). In the western Pacific, nesting information is not available for several countries, but information from Indonesia suggests an increase in nesting, while information from Malaysia and Thailand suggests that nesting has declined to very low levels in those countries (NMFS 2004). In the Indian Ocean, olive ridleys nest in great abundance in eastern India and Sri Lanka, although minor nesting also occurs at other localities. Gahirmatha, located in the Bhitarkanika Wildlife Sanctuary, India, supports perhaps one of the largest nesting populations in the world with an average of 398,000 females nesting in a given year. These populations, however, are suffering high mortality from nearshore gillnets and trawl fisheries.

3.4.5.2 Atlantic Ocean.

A small and declining population of olive ridleys nests in the western Atlantic, primarily along the coasts of Suriname and French Guiana. The best studied is the relatively large aggregation in Suriname, but numbers there have decreased dramatically, and there have been recommendations that the western Atlantic population be reclassified as endangered (Reichart, 1993). As is the case with olive ridleys in the Pacific, the overall range of the species is much broader than the nesting range. Sporadic sightings of olive ridleys have occurred in the Caribbean and recently in Florida, and one confirmed individual was captured on a longline set in the northern Atlantic Ocean.

Life history and Distribution
Age at sexual maturity for olive ridleys is not known, but if similar to its close relative the Kemp's ridley, it would be 7 to 15 years. Olive ridleys typically nest 1 to 3 times per season, producing about 100 to110 eggs on each occasion. The inter-nesting interval is variable, but for

most localities it is approximately 14 days for solitary nesters and 28 days for arribada nesters. Incubation takes about 50 to 60 days.

As described above, there are no known nesting sites for olive ridleys in U.S. waters. In the past several years, olive ridley turtles have been occasionally documented in stranding records in the southeastern U.S. and U.S. Caribbean, where they had never been documented before. In addition, the documented capture of an olive ridley in the NED experiment in 2003 is the first known interaction with the HMS pelagic longline fishery. Caution should be used to avoid over interpreting these very few occurrences, but the change from absence to presence in U.S. Atlantic records is notable.

There are surprisingly few data relating to the feeding habits of the olive ridley. However, those reports that do exist suggest that the diet in the western Atlantic and eastern Pacific includes crabs, shrimp, rock lobsters, jellyfish, and tunicates. In some parts of the world, it has been reported that the principal food is algae.

Population Dynamics and Status

The olive ridley is widely regarded as the most abundant sea turtle in the world because of the continued existence of several large arribadas. However, since its listing under the ESA, there has been a decline in abundance of this species in the western Atlantic, probably the result of continued direct and incidental take, particularly in shrimp trawl nets and nearshore gill nets. The western North Atlantic (Suriname, French Guiana, and Guyana) nesting population has declined more than 80 percent since 1967. Similar declines have been seen in the Pacific, although some nesting populations appear to be stable or increasing as described above. The Indian Ocean continues to support one of the largest nesting populations in the world. However, these populations are also known to suffer high anthropogenic mortality from fishery interactions.

Threats

The decline of this species is primarily due to human activities, including the direct harvest of adults and eggs, incidental capture in commercial fisheries, and loss of nesting habitat. However, their characteristic form of nesting, the arribada, also leaves then susceptible to natural predation (as well as poaching) and a high incidence of incidental nest destruction by other nesting turtles. Even the close proximity of a rotting nest can lead to bacterial contamination and destruction of all or part of the surrounding nests (NMFS 2004).

3.4.5.3 Summary of Status for Olive Ridley Sea Turtles

The western North Atlantic (Suriname, French Guiana, and Guyana) nesting population has declined more than 80 percent since 1967. Anthropogenic impacts similar to those experienced by other sea turtle species (i.e., such as fishing interactions and poaching) appear to be primarily responsible for the decline. There are no olive ridley turtle nesting sites within the U.S. In the past several years, however, olive ridley turtles have been occasionally documented in stranding records in the southeastern U.S. and U.S. Caribbean, where they had never been documented before. In addition, in 2003, the NED experimental longline fishery in the northern western Atlantic documented capture of an olive ridley sea turtles. Caution should be used to avoid overinterpreting these very few occurrences, but the change from absence to presence in U.S. Atlantic records is notable.

3.4.6 Hawksbill Sea Turtle

The hawksbill turtle was listed as endangered under the precursor of the ESA on June 2, 1970, and is considered Critically Endangered by the International Union for the Conservation of Nature (IUCN). The hawksbill is a medium-sized sea turtle with adults in the Caribbean ranging in size from approximately 62.5 to 94.0 cm straight carapace length. The species occurs in all ocean basins, although it is relatively rare in the Eastern Atlantic and Eastern Pacific, and absent from the Mediterranean Sea. Hawksbills are the most tropical of the marine turtles, ranging from approximately 30° N latitude to 30° S latitude. They are closely associated with coral reefs and other hard-bottom habitats, but they are also found in other habitats including inlets, bays and coastal lagoons (NMFS and USFWS 1993). There are five regional nesting populations with more than 1,000 females nesting annually. These populations are in the Seychelles, Mexico, Indonesia, and two in Australia (Meylan and Donnelly 1999). There has been a global population decline of over 80% during the last three generations (105 years) (Meylan and Donnelly 1999).

3.4.6.1 Pacific Ocean.

Anecdotal reports throughout the Pacific indicate that the current population is well below historical levels (NMFS 2004). It is believed that this species is rapidly approaching extinction in the Pacific because of harvesting for its meat, shell, and eggs as well as destruction of nesting habitat (NMFS 2001). Hawksbill sea turtles nest in the Hawaiian Islands as well as the islands and mainland of southeast Asia, from China to Japan, and throughout the Philippines, Malaysia, Indonesia, Papua New Guinea, the Solomon Islands, and Australia (NMFS 2004). However, along the eastern Pacific rim where nesting was common in the 1930's, hawksbill's are now rare or absent (Cliffton et al. 1982; NMFS 2004).

3.4.6.2 Atlantic Ocean.

In the Western Atlantic, the largest hawksbill nesting population occurs in the Yucatán Peninsula of Mexico (Garduño-Andrade et al. 1999). With respect to the U.S., nesting occurs in Puerto Rico, the U.S. Virgin Islands, and the southeast coast of Florida. Nesting also occurs outside of the U.S. and its territories in Antigua, Barbados, Costa Rica, Cuba, and Jamaica (Meylan 1999a). Outside of the nesting areas, hawksbills have been seen off of the U.S. gulf states and along the eastern seaboard as far north as Massachusetts, although sightings north of Florida are rare (NMFS 2004).

Life History and Distribution
The best estimate of age at sexual maturity for hawksbill sea turtles is about 20-40 years (Chaloupka and Limpus 1997; Crouse 1999a; NMFS 2004). Reproductive females undertake periodic (usually non-annual) migrations to their natal beach to nest. Movements of reproductive males are less well known, but are presumed to involve migrations to the nesting beach or to courtship stations along the migratory corridor (Meylan 1999b). Females nest an average of 3-5 times per season (Meylan and Donnelly 1999, Richardson et al. 1999). Clutch size is larger on average (up to 250 eggs) than that of other turtles (Hirth 1980). Reproductive females may exhibit a high degree of fidelity to their nest sites.

The life history of hawksbills consists of a pelagic stage that lasts from the time they leave the nesting beach as hatchlings until they are approximately 22 - 25 cm in straight carapace length (Meylan 1988, Meylan and Donnelly 1999), followed by residency in developmental habitats (foraging areas where immatures reside and grow) in coastal waters. Adult foraging habitat, which may or may not overlap with developmental habitat, is typically coral reefs, although other hard-bottom communities and occasionally mangrove-fringed bays may be occupied. Hawksbills show fidelity to their foraging areas over several years (van Dam and Diez 1998).

The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan 1988) although other food items, notably corallimorphs and zooanthids, have been documented to be important in some areas of the Caribbean (van Dam and Diez 1997, Mayor et al. 1998, Leon and Diez 2000).

Population Dynamics and Status
Estimates of the annual number of nests at hawksbill sea turtle nesting sites are of the order of hundreds to a few thousand. Nesting within the southeastern U.S. and U.S. Caribbean is restricted to Puerto Rico (>650 nests/yr), the U.S. Virgin Islands (~400 nests/yr), and, rarely, Florida (0-4 nests/yr) (Eckert 1995, Meylan 1999a, Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute's Statewide Nesting Beach Survey data 2002). At the two principal nesting beaches in the U.S. Caribbean where long-term monitoring has been carried out, populations appear to be increasing (Mona Island, Puerto Rico) or stable (Buck Island Reef National Monument, St. Croix, USVI) (Meylan 1999a).

Threats
As described above for other sea turtle species, hawksbill sea turtles are affected by habitat loss, habitat degradation, fishery interactions, and poaching in some parts of their range. There continues to be a black market for hawksbill shell products ("tortoiseshell"), which likely contributes to the harvest of this species.

3.4.6.3 Summary of Status for Hawksbill Sea Turtles

Worldwide, hawksbill sea turtle populations are declining. They face many of the same threats affecting other sea turtle species. In addition, there continues to be a commercial market for hawksbill shell products despite protections afforded to the species under U.S. law and international conventions.

3.5 Environmental Baseline

This section contains an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, their habitat, and the ecosystem, within the action area. The environmental baseline is a snapshot of the factors affecting the species and includes federal, state, tribal, local, and private actions already affecting the species, or that will occur contemporaneously with the consultation in progress. Unrelated, future federal actions affecting the same species that have completed formal or informal consultation are also part of the environmental baseline, as are implemented and ongoing federal and other actions within the action area that may benefit listed species.

3.5.1 Factors Affecting Sea Turtles in the Action Area

The environmental baseline for this opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species in the action area. As noted above, sea turtles found in the action area may travel widely throughout the Atlantic, Gulf of Mexico, and Caribbean Sea. Therefore, individuals found in the action area can potentially be affected by activities anywhere within this wide range. The most thorough account of permitted and non-permitted activities, including research activities that are not harmful to the turtles, in the entire U.S. Atlantic, Gulf of Mexico, and Caribbean can be found in Appendix 2 of the NOAA Technical Memorandum NMFS-SEFSC-455, *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).

The most significant activities affecting sea turtles in the Atlantic are fisheries and conservation activities directed at fisheries. Other environmental impacts to turtles may result from vessel operations, discharges, dredging, military activities, oil and gas development activities, industrial cooling water intake, aquaculture, recreational fishing, coastal development, directed take, and marine debris.

3.5.1.1 Federal Actions

In recent years, NOAA Fisheries has undertaken numerous ESA section 7 consultations to address the effects of federally-permitted fisheries and other federal actions on threatened and endangered sea turtle species. Each of those consultations sought to develop ways of reducing the probability of adverse effects of the action on sea turtles. Similarly, recovery actions NOAA Fisheries has undertaken under the ESA are addressing the problem of take of sea turtles in the fishing and shipping industries and other activities such as Army Corps of Engineers (COE) dredging operations. The summary below of anticipated sources of incidental take of sea turtles from federal actions includes only those actions which have already concluded or are currently undergoing formal section 7 consultation.

Fisheries
Adverse effects on threatened and endangered sea turtles from several types of fishing gear occur in the action area. Gillnet, longline, trawl gear, and pot fisheries have all been documented as interacting with sea turtles. For all fisheries for which there is a fishery management plan (FMP) or for which any federal action is taken to manage that fishery, impacts have been evaluated under section 7. Formal section 7 consultations have been conducted on the following fisheries that NOAA Fisheries has determined are likely to adversely affect threatened and endangered sea turtles : American lobster, Atlantic bluefish, Atlantic herring, Atlantic mackerel/squid/Atlantic butterfish, Atlantic sea scallop, dolphin/wahoo, monkfish, northeast multispecies, red crab, skate, spiny dogfish, southeastern shrimp trawl fishery, commercial directed shark, summer flounder/scup/black sea bass fisheries, and tilefish. An Incidental Take Statement (ITS) has been issued for the take of sea turtles in each of the fisheries. A summary of each consultation is provided below but more detailed information can be found in the respective opinions.

The *American lobster trap fishery* has been identified as a source of gear causing serious injuries and mortality of leatherback sea turtles. Consultation on the American lobster pot fishery was reinitiated in 2002 to consider the effects of limited access for parts of the federal lobster management area, and implementation of a conservation equivalency measure for state-permitted New Hampshire lobster fishers who also held a federal lobster permit. This consultation concluded, on October 31, 2002, that the proposed action was not likely to jeopardize the continued existence of leatherbacks but was expected to result in the take of one additional leatherback sea turtle biennially. NOAA Fisheries reinitiated consultation on the federal lobster fishery on July 29, 2003, because of its impacts on right whale. This consultation is on-going but is not expected to reconsider the effects of the fishery on leatherbacks.

The *Atlantic Bluefish fishery* may pose a risk to protected marine mammals, but is most likely to interact with sea turtles (primarily Kemp's ridley and loggerheads) given the time and locations where the fishery occurs. Gillnets are the primary gear used to commercially land bluefish. Turtles can become entangled in the buoy lines of the gillnets or in the net panels.

Section 7 consultation was completed on the *Atlantic Herring* FMP on September 17, 1999, and concluded that the federal herring fishery may adversely affect loggerhead, leatherback, Kemp's ridley, and green sea turtles as a result of capture in gear used in the fishery. NOAA Fisheries currently authorizes the use of trawl, purse seine, and gillnet gear in the commercial herring fishery (64 FR 4030). There is no direct evidence of takes of ESA-listed species in the herring fishery from the NOAA Fisheries sea sampling program. However, observer coverage of this fishery has been minimal. Sea turtles have been captured in comparable gear used in other fisheries that occur in the same area as the herring fishery. Because much of the herring fishery occurs in state waters, the fishery is managed in these waters under the guidance of the Atlantic States Marine Fisheries Commission (ASMFC). The ASMFC plan, implemented through regulations promulgated by member states, is expected to benefit sea turtles by reducing effort in the herring fishery.

The *Atlantic Mackerel/Squid/Atlantic Butterfish fishery* is known to take sea turtles. Several types of gillnet gear may be used in the mackerel/squid/butterfish fishery. Other gear types that may be used in this fishery include midwater and bottom trawl gear, pelagic longline/hook-and-line/handline, pot/trap, dredge, poundnet, and bandit gear. Entanglements or entrapments of sea turtles have been recorded in one or more of these gear types.

It was previously believed that the *Atlantic Sea Scallop fishery* was unlikely to take sea turtles given differences in depth and temperature preferences for sea turtles and the optimal areas where the fishery occurs. However, after the reopening of a closed area in the mid-Atlantic, and the accumulation of more extensive observer effort, NOAA Fisheries initiated formal section 7 consultation on the fishery. NOAA Fisheries concluded that operation of the fishery may adversely affect loggerhead, Kemp's ridley, green, and leatherback sea turtles as a result of capture in scallop dredge and/or trawl gear. Consultation was reinitiated in 2003 following receipt of additional information on the capture of sea turtles in scallop dredge gear. A new ITS was provided for sea turtles. NOAA Fisheries anticipates additional information from the Northeast Fisheries Science Center in 2004 may result in reinitiation of consultation.

The FMP for the *Dolphin/Wahoo fishery* was approved in December 2003. NOAA Fisheries conducted a formal section 7 consultation to consider the effects of implementation of the FMP on sea turtles. The biological opinion concluded that loggerhead, leatherback, hawksbill, green, and Kemp's ridley sea turtles may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of any of these species. An ITS has been provided.

The federal *Monkfish fishery* occurs in all waters under federal jurisdiction from Maine to the North Carolina/South Carolina border. The current commercial fishery operates primarily in the deeper waters of the Gulf of Maine, Georges Bank, and southern New England, and in the Mid-Atlantic. The monkfish fishery uses several gear types that may entangle sea turtles, including gillnet and trawl gear. NOAA Fisheries reinitiated consultation on the Monkfish FMP on May 4, 2000, in part, to reevaluate the effects of the monkfish gillnet fishery on sea turtles. A new ITS was provided for the take of sea turtles in the fishery as a result of capture in monkfish gillnet and trawl gear. Consultation was subsequently reinitiated in 2002 and 2003 to consider, first, the one year delay in reducing Days-at-Sea (DAS) to zero (which would have effectively eliminated directed monkfish fishing effort) and then elimination of the DAS reduction altogether. A new ITS was provided for sea turtles in each case. Reducing DAS to zero would have likely been of benefit to sea turtles by eliminating directed gillnet and trawl effort in the fishery. In March 2002, NOAA Fisheries published new restrictions for the use of gillnets with larger than 8 inch (20.3 cm) stretched mesh, in federal waters (3-200 nautical miles) off of North Carolina and Virginia. These restrictions were published in an Interim Final Rule under the authority of the Endangered Species Act (67 FR 13098) and were implemented to reduce the impact of the monkfish and other large-mesh gillnet fisheries on endangered and threatened species of sea turtles in areas where they are known to concentrate. Following review of public comments submitted on the Interim Final Rule, NOAA Fisheries published a Final Rule on December 3, 2002, that establishes the restrictions on an annual basis. These measures are in addition to Harbor Porpoise Take Reduction Plan measures in place that prohibit the use of large-mesh gillnets in southern Mid-Atlantic waters (territorial and federal waters from Delaware through North Carolina out to 72° 30'W longitude) from February 15-March 15, annually. Operation of the gillnet sector of the monkfish fishery is further modified by management measures implemented under the Atlantic Large Whale Take Reduction Plan (ALWTRP).

Multiple gear types are used in the *Northeast Multispecies fishery*. However, the gear type of greatest concern is sink gillnet gear that can entangle sea turtles (*i.e.*, in buoy lines and/or net panels). The northeast multispecies sink gillnet fishery has historically occurred from the periphery of the Gulf of Maine to Rhode Island in water as deep as 60 fathoms. In recent years, more of the effort in the fishery has occurred in offshore waters and into the Mid-Atlantic. Participation in this fishery has declined because extensive groundfish conservation measures have been implemented; the latest of these occurring under Amendment 13 to the Multispecies FMP. Effort in the fishery is expected to be significantly reduced as a result of the Amendment 13 measures.

The *Red crab fishery* is a pot/trap fishery that occurs in deep waters along the continental slope. There have been no recorded takes of ESA-listed species in the red crab fishery. However, given the type of gear used in the fishery, takes of loggerhead and leatherback sea turtles may be possible where gear overlaps with the distribution of ESA-listed species. An ITS has been provided.

Traditionally, the main gear types used in the *Skate fishery* include mobile otter trawls, gillnet gear, hook and line, and scallop dredges, although bottom trawling is by far the most common gear type, accounting for 94.5% of skate landings. Gillnet gear is the next most common gear type, accounting for 3.5% of skate landings. The Northeast skate complex is comprised of seven different skate species. The seven species of skate are distributed along the coast of the northeast U.S. from the tide line to depths exceeding 700m (383 fathoms). There have been no recorded takes of ESA-listed species in the skate fishery. However, given that sea turtles interactions with trawl and gillnet gear have been observed in other fisheries, sea turtle takes in gear used in the skate fishery may be possible where the gear and sea turtle distribution overlap. Section 7 consultation on the new Skate FMP was completed July 24, 2003, and concluded that implementation of the Skate FMP may adversely affect ESA-listed sea turtles as a result of interactions with (capture in) gillnet and trawl gear. An ITS was provided.

The primary gear types for the *Spiny dogfish fishery* are sink gillnets, otter trawls, bottom longline, and driftnet gear. Spiny dogfish are landed in every state from Maine to North Carolina, throughout a broad area with the distribution of landings varying by area and season. During the fall and winter months, spiny dogfish are captured principally in Mid-Atlantic waters from New Jersey to North Carolina. During the spring and summer months, spiny dogfish are landed mainly in northern waters from NY to ME. Sea turtles can be incidentally captured in all gear sectors of this fishery. NOAA Fisheries reinitiated consultation on the Spiny Dogfish FMP on May 4, 2000, to reevaluate, in part, the effects of the spiny dogfish gillnet fishery on sea turtles. A new ITS has been provided for the take of sea turtles in the fishery.

The FMP for spiny dogfish called for a 30% reduction in quota allocation levels for 2000 and a 90% reduction in 2001. Although there have been delays in implementing the plan, quota allocations are expected to be substantially reduced over the 4½ year rebuilding schedule which should result in a substantial decrease in effort directed at spiny dogfish. The reduction in effort should be of benefit to protected species by reducing the number of gear interactions that occur.

The *Southeast shrimp trawl fishery* affects more sea turtles than all other activities combined (NRC 1990). On December 2, 2002, NOAA Fisheries completed the opinion for shrimp trawling in the southeastern United States under proposed revisions to the TED regulations (68 FR 8456, February 21, 2003). This opinion determined that the shrimp trawl fishery under the revised TED regulations would not jeopardize the continued existence of any sea turtle species. This determination was based, in part, on the opinion's analysis that shows the revised TED regulations are expected to reduce shrimp trawl related mortality by 94 percent for loggerheads and 97 percent for leatherbacks.

The *Summer Flounder, Scup and Black Sea Bass fisheries* are known to interact with sea turtles. Summer flounder, scup and black sea bass are managed under one FMP since these species occupy similar habitat and are often caught at the same time. They are present in offshore waters throughout the winter and migrate and occupy inshore waters throughout the summer. The primary gear types used in the summer flounder, scup and black sea bass fisheries are mobile trawl gear, pots and traps, gillnets, pound nets, and handlines. Significant measures have been developed to reduce the take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which would include fisheries for other species like scup and black sea bass) by requiring the use TEDs throughout the year for trawl nets fished from the North Carolina/South Carolina border to Oregon Inlet, North Carolina and seasonally (March 16-January 14) for trawl vessels fishing between Oregon Inlet, North Carolina and Cape Charles, Virginia. Developmental work is also ongoing for a TED that will work in the flynets used in the summer flounder fisheries. The gillnet, pot gear and staked trap sectors could also entangle whales and sea turtles. As a result of new information not considered in previous consultations, NOAA Fisheries has reinitiated section 7 consultation on this FMP to consider the effects of the fisheries on sea turtles.

The North Carolina inshore fall *southern flounder gillnet fishery* was identified as a source of large numbers of sea turtle mortalities in 1999 and 2000, especially loggerhead sea turtles. In 2001, NOAA Fisheries issued an ESA section 10 permit to North Carolina with mitigative measures for the southern flounder fishery. Subsequently, the sea turtle mortalities in these fisheries were drastically reduced. The reduction of sea turtle mortalities in these fisheries reduces the negative effects these fisheries have on the environmental baseline.

The management unit for the *Tilefish* FMP is all golden tilefish under U.S. jurisdiction in the Atlantic Ocean north of the Virginia/North Carolina border. Tilefish have some unique habitat characteristics, and are found in a warm water band (8-18º C) approximately 250 to 1200 feet deep on the outer continental shelf and upper slope of the U.S. Atlantic coast. Because of their restricted habitat and low biomass, the tilefish fishery in recent years has occurred in a relatively small area in the Mid-Atlantic Bight, south of New England and west of New Jersey. Section 7 consultation was completed on this newly regulated fishery in March 2001. An ITS is provided for loggerhead and leatherback sea turtles.

Formal Section 7 consultation has also been conducted for the issuance of an Exempted Fisheries Permit (EFP) for the collection of horseshoe crabs from the Carl N. Shuster, Jr. Federal Horseshoe Crab Reserve (in federal waters off of the mouth of Delaware Bay), and for an EFP for Jonah crab. The EFP for the collection of horseshoe crabs was first issued in October 2001 and includes an ITS for loggerhead sea turtles (NOAA Fisheries 2001b). Horseshoe crabs collected under this permit are used for data collection on the species and to obtain blood for biomedical purposes. The EFP for Jonah crab was issued to the Maine Department of Marine Fisheries to allow lobster trap fishers to fish additional (modified) lobster traps in federal waters off of Maine in order to determine the traps efficiency at catching Jonah crabs while excluding lobster. The biological opinion concluded, in part, that the proposed activities may adversely affect but were not likely to jeopardize the continued existence of leatherback sea turtles. An ITS as well as non-discretionary RPMs and discretionary Conservation Recommendations were provided to address the anticipated take of leatherback sea turtles.

Vessel Operations

Potential sources of adverse effects from federal vessel operations in the action area and throughout the range of sea turtles include operations of the U.S. Navy (USN) and Coast Guard (USCG), the Environmental Protection Agency, the National Oceanic and Atmospheric Administration (NOAA), and the COE. NOAA Fisheries has conducted formal consultations with the USCG, the USN, and NOAA on their vessel operations. Through the section 7 process, where applicable, NOAA Fisheries has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. At the present time, however, they present the potential for some level of interaction.

In addition to vessel operations, other military activities including training exercises and ordnance detonation also affect sea turtles and cetaceans. Consultations on individual activities have been completed, but no formal consultation on overall USCG or USN activities in any region has been completed at this time.

Dredging
The construction and maintenance of federal navigation channels has also been identified as a source of sea turtle mortality. Hopper dredges move relatively rapidly (compared to sea turtle swimming speeds) and can entrain and kill sea turtles, presumably as the drag arm of the moving dredge overtakes the slower moving sea turtle. A regional opinion with the COE's South Atlantic Division has been completed for the southeastern Atlantic waters. Consultation on a new regional opinion for the COE's Gulf of Mexico hopper dredging operations was completed in November, 2003.

Oil and Gas Exploration
The COE and the Minerals Management Service (MMS) authorize oil and gas exploration, well development, production, and abandonment/rig removal activities that also may adversely affect sea turtles. Both of these agencies have consulted with NOAA Fisheries on these types of activities. These activities include the use of seismic arrays for oil and gas exploration in the Gulf of Mexico, the impacts of which have been addressed in opinions for individual and multi-lease sales. These impacts are expected to result from vessel strikes, noise, marine debris, and the use of explosives to remove oil and gas structures.

Electrical Generating Plants
Another action with federal oversight (the Federal Energy Regulatory Commission and the Nuclear Regulatory Agency) which has impacts on sea turtles is the operation of electrical generating plants. Sea turtles entering coastal or inshore areas have been affected by entrainment in the cooling-water systems of electrical generating plants, though it is important to note that almost all of the turtles are caught and released alive; NOAA Fisheries estimates the survival rate at 98.5% or greater (NMFS 1997). Biological opinions have already been written for a number of electrical generating plants, and others are currently undergoing section 7 consultation.

3.5.1.2 State or Private Actions

Vessel Traffic
Commercial traffic and recreational pursuits can adversely effect sea turtles through propeller and boat strikes. Private vessels participate in high speed marine events concentrated in the southeastern United States and are a particular threat to sea turtles. The magnitude of these marine events is not currently known. NOAA Fisheries 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.

State Fisheries
Various fishing methods used in state fisheries, including trawling, pot fisheries, fly nets, and gillnets are known to incidentally take listed species, but information on these fisheries is sparse (NMFS SEFSC 2001). Although few of these state regulated fisheries are currently authorized to

incidentally take listed species, several state agencies have approached NOAA Fisheries to discuss applications for a section 10(a)(1)(B) incidental take permit. Since NOAA Fisheries' issuance of a section 10(a)(1)(B) permit requires formal consultation under section 7 of the ESA, the effects of these activities are considered in section 7 consultation. Any fisheries that come under a section 10(a)(1)(B) permit in the future will likewise be subject to section 7 consultation. Although the past and current effects of these fisheries on listed species is currently not determinable, NOAA Fisheries 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 of Mexico coasts. Most of the state data are based on extremely low observer coverage or sea turtles were not part of data collection; thus, these data provide insight into gear interactions that could occur but are not indicative of the magnitude of the overall problem. In addition to the lack of interaction data, there is another issue that complicates the analysis of impacts to sea turtles from these fisheries. 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.

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 NOAA Fisheries- 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. NOAA Fisheries is testing designs for TEDs that may be required in the flynet fishery in the future.

Other state bottom trawl fisheries that are suspected of incidentally capturing 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 six 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 six 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 three Kemp's ridley, two green, and two loggerhead sea turtles captured in 28 tows for a CPUE of 0.3097 turtles/100 ft net hour. As of December 2000, TEDS are required in Georgia state waters when trawling for whelk. There has also been one report of a loggerhead captured in a Florida try net (W. Teas, pers. comm.). Trawls for cannonball jellyfish may also be a source of interactions.

A detailed summary of the gillnet fisheries currently operating along the mid- and southeast U.S. Atlantic coastline, which 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 SEFSC 2001).

Georgia and South Carolina prohibit gillnets for all but the shad fishery. This fishery was observed in South Carolina for one season by the NOAA Fisheries 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 had been implicated in large numbers of sea turtle mortalities. The Pamlico Sound portion of that fishery was closed and has subsequently been reopened under a section 10(a)(1)(B) permit.

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 SEFSC 2001).

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 SEFSC 2001).

Observations of state recreational fisheries have shown that loggerhead, leatherback, Kemp's ridley, and green sea turtles are known to bite baited hooks, and loggerheads and Kemp's ridleys frequently ingest the hooks. Recreational fishermen have reported hooking turtles when fishing from boats, piers, and beach, banks, and jetties. Commercial fishermen fishing for reef fish and for sharks with both single rigs and bottom longlines have also reported hooked turtles (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).

Coastal Development
Beachfront development, lighting and beach erosion control all are ongoing activities along the Gulf of Mexico 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.

3.5.1.3 Other Sources of Impacts

International
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 NMFS SEFSC (2001) concludes that it could alter population trends. Takes in international gillnet fisheries are also known to be prevalent. Additional information on the impacts of international fisheries is found in NMFS SEFSC (2001) and Lewison et al. (2004). NOAA Fisheries estimates that, each year, thousands of sea turtles of all species are incidentally caught and a proportion of them killed incidentally or intentionally by international activities. The impact of international fisheries is a significant factor in the baseline inhibiting sea turtle recovery.

Significant anthropogenic impacts threaten nesting populations of all species in areas outside of the U.S. These 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 NOAA Fisheries SEFSC (2001).

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, conservation actions are being implemented to monitor or study impacts from these sources. 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 of Mexico 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.

Disease
A little understood 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 re-emerges 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 the diseased turtles found alive, even with extensive care, many 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.

Acoustic impacts
NOAA Fisheries and the USN have been working cooperatively to establish a policy for monitoring and managing acoustic impacts from anthropogenic sound sources in the marine environment. Acoustic impacts to sea turtles can include temporary or permanent injury, habitat exclusion, habituation, and disruption of other normal behavior patterns.

3.5.1.4 Conservation and Recovery Actions Benefitting Sea Turtles

NOAA Fisheries has implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial fisheries. In particular, NOAA Fisheries 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 percent of the sea turtles caught in such trawls. These 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 (2002) indicated that the minimum requirements for the escape opening dimensions in TEDs in use at that time were too small, and that as many as 47 percent of the loggerheads stranding annually along the Atlantic Seaboard and Gulf of Mexico were too large to fit through existing openings. On February 21, 2003, NOAA Fisheries published a final rule to require larger escape openings in TEDs used in the southeast shrimp trawl fishery (68 FR 8456, February 21, 2003). Based upon the analyses in Epperly et al. (2002), leatherback and loggerhead sea turtles will greatly benefit from the new regulations, with expected reductions of 97 percent and 94 percent, respectively, in mortality from shrimp trawling. Several states have regulations requiring the use of TEDs in state-regulated trawl fisheries, and the federal regulations also apply in state waters.

In 1993 (with a final rule implemented in 1995), NOAA Fisheries established a Leatherback Conservation Zone to restrict shrimp trawl activities from the coast of Cape Canaveral, Florida, to the North Carolina/Virginia border. This provided for short-term closures when high concentrations of normally pelagically-distributed leatherbacks are recorded in near coastal waters where the shrimp fleet operates. This measure was necessary because, due to their size, adult leatherbacks were larger than the escape openings of most NOAA Fisheries-approved TEDs. With the implementation of the new TED rule requiring larger opening sizes on all TEDs, the reactive emergency closures within the Leatherback Conservation Zone became unnecessary, and the Leatherback Conservation Zone was removed from the regulations.

NOAA Fisheries 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. Prototype designs have been tested since December 2002, but an effective TED for this fishery has not yet been developed. Development of a larger TED for the winter trawl fishery is also underway.

NOAA Fisheries 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. NOAA Fisheries also closed the waters north of Cape Hatteras to 38° N latitude, 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 percent of the animals that stranded off the Carolinas, and 46 percent 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 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). The fishery has subsequently been reopened under a section 10(a)(1)(B) permit.

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

Existing information indicates that pound nets with large mesh and stringer leaders as used in the Chesapeake Bay incidentally take sea turtles. To address the high and increasing level of sea turtle strandings, NOAA Fisheries published a temporary rule in June 2001 (66 FR 33489) that prohibited fishing with pound net leaders with a mesh size measuring 8 inches or greater (20.3 cm) and pound net leaders with stringers in mainstream waters of the Chesapeake Bay and its tributaries for a 30-day period beginning June 19, 2001. NOAA Fisheries subsequently published an Interim Final Rule in 2002 (67 FR 41196, June 17, 2002) that further addressed the take of sea turtles in large-mesh pound net leaders and stringer leaders used in the Chesapeake Bay and its tributaries. Following new observations of sea turtle entanglements in pound net leaders in the spring of 2003, NOAA Fisheries issued a temporary final rule (68 FR 41942, July 16, 2003) that restricted all pound net leaders throughout Virginia's waters of the Chesapeake Bay and a portion of its tributaries from July 16-July 30, 2003. As a follow-up to this action, NOAA Fisheries recently published a final rule (69 FR 24997, May 5, 2004) that prohibits the use of all pound net leaders, set with the inland end of the leader greater than 10 horizontal feet

(3m) from the, mean low water line, from May 6 to July 15 each year in the mainstream waters of the Chesapeake Bay, south of 37° 19.0' N. latitude and west of 76° 13.0' W. longitude, and all waters south of 37° 13.0' N. latitude to the Chesapeake Bay Bridge Tunnel at the mouth of the Chesapeake Bay, and the James and York Rivers downstream of the first bridge in each tributary. Outside this area, the prohibition of leaders with greater than or equal to 12 inches (30.5 cm) stretched mesh and leaders with stringers, as established by the June 17, 2002, interim final rule, will apply from May 6 to July 15 each year. The final rule also includes a framework mechanism by which NMFS may take additional action as necessary.

As described above for the Atlantic sea scallop fishery, NOAA Fisheries received new information in 2001 which demonstrated that scallop dredge gear posed a risk of injury and mortality for hard-shelled sea turtles as a result of being captured in the dredge. Subsequently, industry representatives and interested parties began working in conjunction with NOAA Fisheries, Northeast Fisheries Science Center to test a modified dredge that is intended to reduce the risk of sea turtle captures in the gear. The first year of the study produced promising results. Further testing is planned for 2004.

NOAA Fisheries has also been active in public outreach efforts to educate fishermen regarding sea turtle handling and resuscitation techniques. As well as making this information widely available to all fishermen, NOAA Fisheries recently conducted a number of workshops with HMS pelagic longline fishermen to discuss bycatch issues including protected species, and to educate them regarding handling and release guidelines. NOAA Fisheries intends to continue these outreach efforts and hopes to reach all fishermen participating in the HMS pelagic longline fishery over the next one to two years. There is also an extensive network of Sea Turtle Stranding and Salvage Network participants along the Atlantic and Gulf of Mexico coasts who not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded sea turtles.

Loggerheads, leatherbacks, 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, beaches, banks, and jetties. Necropsies have revealed hooks internally, which often were the cause of death. NOAA Fisheries currently is exploring adding questions about encounters with sea turtles to intercept interviews of recreational fishermen conducted by the Texas Parks and Wildlife Department under the auspices of the Marine Recreational Fishery Statistics Surveys conducted throughout the Gulf of Mexico and along the Atlantic Coast as well as adding such information to the MRFSS database. NOAA Fisheries 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).

The Recovery Plans for loggerhead and Kemp's ridley sea turtles are in the process of being updated. Recovery teams comprised of sea turtle experts have been convened and are currently working towards revising these plans based upon the latest and best available information.

4.0 EFFECTS OF THE PROPOSED ACTION

In this section of the opinion, we assess whether it is reasonable to expect the HMS pelagic longline fishery, as conducted under the proposed regulations, to appreciably reduce the likelihood of survival and recovery of threatened and endangered species in the wild. This section begins with a discussion of the factors to be considered in that assessment. Specifically, we will assess the types of effects expected from the proposed action and discuss some of the available data and assumptions used in making our overall assessment. Then, we will look at the extent of those effects.

4.1 Approach to the Effects Analysis

4.1.1 Scope of the Analysis

Although all six species of sea turtles are potentially impacted by the Atlantic pelagic longline fishery, leatherback and loggerhead turtles are by far the dominant species caught. Interactions with green, Kemp's ridley, hawksbill, and olive ridley turtles occur only on rare occasions. Moreover, the 2001 opinion on HMS fisheries concluded that the fisheries, as prosecuted without the proposed regulations, would not jeopardize the continued existence of any of these less frequently caught species. There is no new information to alter that conclusion; therefore, the effects analysis focuses on loggerhead and leatherback sea turtles.

The analysis in this section forms the foundation for our jeopardy determination. A jeopardy determination is reached if we would reasonably expect a proposed action to cause reductions in numbers, reproduction, or distribution that would appreciably reduce a listed species' likelihood of surviving and recovering in the wild. The ESA defines an endangered species as "...in danger of extinction throughout all or a significant portion of its range..." and a threatened species as "...likely to become an endangered species within the foreseeable future..." Sea turtles are listed because of their global status; on a worldwide basis, the loggerhead turtle is listed as threatened, and the leatherback turtle is listed as endangered. A jeopardy determination must find that the proposed action will appreciably reduce the likelihood of survival and recovery of the global species.

The Atlantic and Pacific Ocean populations of both loggerhead and leatherback sea turtles contribute substantially to the total reproduction, numbers, and distribution of their respective species (see Status of the Species for population estimates). For example, the Pacific leatherback sea turtle is at high risk of extinction (Spotila et al. 1996, Spotila et al. 2000); therefore, the global survival of the leatherback turtle is dependent on the survival of Atlantic populations. The loss of either population from a catastrophic event would severely impact the stability and long-term prospects of the global species. Similarly, the Pacific populations of loggerhead turtles are small relative to the Atlantic populations, and in decline. Significant nesting of loggerhead turtles occurred in the Indian Ocean, with the largest nesting assemblage in Oman (Ross and Barwani 1982). However, little new information is available regarding the status of the stock in this region. In addition, the recovery of loggerhead and leatherback sea turtles require meeting the goals of both the Atlantic and the Pacific recovery plans. Thus, reductions in numbers, reproduction, or distribution of either basin's populations could potentially lead to an appreciable reduction in a global species' likelihood of both survival and recovery. The analysis performed in this section will therefore focus on expected impacts to the Atlantic populations as a result of the proposed action occurring in the Atlantic.

4.1.2 Conservative Decisions

The quantitative and qualitative analyses in this section are based upon the best available commercial and scientific data on sea turtle biology and the effects of the proposed action. Frequently, the best available information may include a range of values for a particular aspect under consideration, or different analytical approaches may be applied to the same data sets. In those cases, in keeping with the direction from the U.S. Congress to resolve uncertainty by providing the "benefit of the doubt" to threatened and endangered species [House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)], we will generally select the value yielding the most conservative outcome for sea turtles (i.e., would lead to conclusions of higher, rather than lower, risk to endangered or threatened species).

4.1.2 Consideration of Indirect Effects

When analyzing the effects of any action, it is important that the indirect effects as well as the direct effects be considered. Indirect effects include aspects such as habitat degradation, reduction of prey/foraging base, etc. In the case of the proposed action analyzed in this opinion, there are no expected indirect effects to sea turtles. The operation of the longline fishery (i.e., vessel operations, longline gear deployment and retrieval) is not expected to impact any habitat features of significance to sea turtles in the pelagic environment. Sea turtles do not forage on the longline fishery's target or bycatch species, so prey competition is not a factor. Therefore, all analyses will be based on direct effects.

4.1.3 Consideration of Direct Effects

The gear used by the HMS pelagic longline fishery presents a significant threat to sea turtles. Entangled or hooked turtles can drown if they cannot surface to breathe. Turtles that are released alive may succumb to injuries sustained at the time of capture or from exacerbated trauma from fishing hooks or lines that were ingested, entangling, or otherwise still attached when they were released. Other turtles hooked or entangled may not die from their wounds, but may suffer impaired swimming or foraging abilities, altered migratory behavior, and altered breeding or reproductive patterns.

Although some studies have attempted to examine post-release mortality rates and sub-lethal effects on sea turtles captured in longline fisheries, such long-term effects are very difficult to monitor satisfactorily with existing technologies. Therefore, a quantitative measure of the effect of longlining on sea turtle populations is very challenging. The following discussion summarizes the information on how individual sea turtles are likely to respond to these interactions. The remainder of this section focuses on quantifying direct impacts on individual animals from the proposed action. Section 6 integrates the analysis of this section with the status of the species and cumulative effects and uses quantitative approaches to evaluate the effects of the proposed action on the species' populations.

4.2 Capture on Longline Gear

4.2.1 Factors That May Attract Sea Turtles to Longline Gear

Floats
Sea turtles may be attracted to the floats used on longline gear. According to a study by Arenas and Hall (1992), turtles show a preference for nearly submerged objects floating horizontally, and are strongly attracted to brightly colored objects. Lab experiments have shown sea turtles prefer bright colors (i.e., red and yellow) over dull or darker colors (i.e. black, green or blue) (e.g. Fontaine, et al. 1985). Controlled experiments and qualitative evaluations were conducted by the SEFSC using captive reared sea turtles to evaluate their responses to various components of pelagic longlining gear and other stimuli. One experiment tested the attraction of sea turtles to orange and white colored longline floats in a 80' x 35' pen enclosure. Sea turtles were introduced into the pen with a single float treatment. Preliminary analysis of the results indicated that the test turtles may have been more attracted to orange-colored floats than to white-colored floats (J. Watson, SEFSC, personal communication, July 2001). Floats typically used during swordfish-style sets are bright orange, bullet-shaped, and slightly submerged. Deep sets generally use larger cylindrical inflatable or rigid spherical buoys and floats, and these also are typically orange in color (L. Enriquez, NOAA Fisheries, personal communication, January 2001; e.g. www.lindgren-pitman.com/floats.htm).

Mainline and hardware
The SEFSC also conducted evaluations at the Panama City Laboratory which involved placing longline gear in open water pens with captive reared loggerhead turtles to investigate turtle entanglement with various longline gear components. During these experiments, scientists observed turtles tracking along the mainline and biting at the hardware (snaps). Turtles placed in a pool without longline gear (i.e., control) tended to track along the outside edges of the pool. These observations support at-sea observations by divers and remotely operated vehicles, which indicate that turtles may be attracted to the highly visible mainline and hardware used by the fishing industry, and that the turtles may swim along the mainline (J. Watson, SEFSC, personal communication, August 2001).

Lightsticks
Sea turtles foraging at night may be attracted to the lightsticks, confusing them for prey or simply investigating novel items in their environment. Lightsticks are often used by longliners targeting swordfish in order to attract the swordfish to the bait. 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 gangion, approximately a meter above the hook. Leatherback, loggerhead, and olive ridley turtles are known to prey on pyrosomas, the so-called "fiery bodies"; however, there is little information on the ingestion of lightsticks by sea turtles. In addition, statisticians have not been able to find any correlation between sea turtle take and the proximity of a lightstick to the hook or branchline the turtle was hooked on or entangled in. Experimental studies have, however, indicated that juvenile sea turtles orient towards green, blue, and yellow chemical lightsticks, and orange, green, and shaded green battery powered LEDs (Wang, et al. 2004).

Bait
Sea turtles may also be attracted to the bait used on longline gear. Four olive ridleys necropsied after being taken dead by Hawaii-based longliners were found with bait in their stomachs (Work 2000). In addition, leatherback turtles are known to eat squid. Skillman and Balazs (1992) speculated the lightsticks used on this gear type may have initially attracted the turtle, by simulating natural prey. As will be discussed later, the NED experiment found significant differences in the catch rates of loggerhead and leatherback turtle based on the bait type used. It is not clear, however, whether it is the bait's attractiveness, its ability to shield the hook, the manner in which turtle feed on different baits, or a combination of behaviors, that is responsible for the effect.

4.2.2 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 gear can wrap around the neck, flipper, or body of a sea turtle and severely restrict swimming or feeding. 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 and causing deep gashes, some severe enough to remove an appendage.

Pelagic longline gear is fluid and drifts according to oceanographic conditions, including 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. Sea turtles have been found entangled in gangions, mainlines and floatlines. Sea turtles 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 gangions (e.g., Hoey 2000). 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 and can force the turtle to remain submerged, causing it to drown.

4.2.3 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. Sea turtles are either hooked externally — generally in the flippers, head, shoulders, armpits, or beak — or internally, inside the mouth or when the animal has swallowed 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). Whereas entanglement and foul hooking is the primary form of interaction that occurs between leatherback turtles and the longline fishery, internal hooking is much more prevalent in hard-shelled turtles, especially loggerheads. Internal hooking of leatherback turtles is much more rare. As NOAA Fisheries became more aware of the differential hooking patterns for different species of turtles and of the implications of hooking location on the severity of the injury from longline interactions, the POP began collecting more detailed information on sea turtle hooking location. Data on hooking location from the Atlantic longline observer program in 1999 and 2000 (in NMFS SEFSC 2001) and from the NED experiment (Watson et al. 2003) agreed closely. For leatherback turtles, the large majority of interactions (at least 75%) are external foul-hookings, usually in the front flipper, shoulder or armpit. The remainder of the interactions are primarily entanglements without hooking; and only a few leatherbacks are hooked in the mouth. For loggerheads, almost all interactions result from taking the bait and hook; only a very small percentage of loggerheads are entangled or foul-hooked externally. Loggerheads caught on J-hooks most often swallow the hooks (67% of interactions in Watson et al. [2003]). The J-hook is the standard hook style in the HMS pelagic longline fishery.

Turtles that have swallowed hooks are of the greatest concern. The esophagus is lined with strong conical papillae directed caudally towards the stomach (White 1994). The presence of these papillae in combination with an S-shaped bend in the esophagus make it difficult to see hooks when looking through a turtle's mouth, especially if the hooks have been deeply ingested. Because of a turtle's digestive structure, deeply-ingested hooks are also very difficult to remove 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 on board 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.

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) 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).

4.2.4 Trailing Line

Trailing line (i.e., line 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, or it may prevent or hamper foraging, leading to eventual death. Sea turtles that swallow monofilament 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. Sea turtles have 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). Long lengths of trailing gear are likely to entangle the turtle eventually, leading to impaired movement, constriction wounds, and potentially death.

4.2.5 Forcible Submergence

Sea turtles can be forcibly submerged by longline gear. Forcible submergence may occur through a hooking or entanglement event, where the turtle is unable to reach the surface to breathe. This can occur at any time during the set, including the setting and hauling of the gear. Forced submergence can occur when the sea turtle encounters a line too deep below the surface, or because the line is too heavy to be brought up to the surface by the swimming sea turtle. For example, a sea turtle hooked on a 3 meter gangion 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). The RPA in the June 14, 2001, opinion specified that gangion length be at least 110% of floatline length on shallow longline sets. This requirement was intended to reduce or eliminate the threat to turtles presented in that example situation.

When interacting with longline gear, hooked sea turtles will sometimes drag the clip, attached to the gangion, along the mainline. If this happens, the potential exists for a turtle to become entangled in an adjacent gangion which may have another species hooked such as a shark, swordfish, or tuna. If a turtle were to drag the gangion against another gangion with a live animal attached, the likelihood of the turtle becoming entangled in the second gangion is greater. If the turtle becomes entangled in the gear, then the turtle may be prevented from reaching the surface. The potential also exists, if a turtle drags the gangion next to a float line, the turtle may wrap itself around the float line and become entangled.

Sea turtles forcibly submerged for extended periods show marked, even severe, metabolic acidosis as a result of high blood lactate levels. With such increased lactate levels, lactate recovery times are as long even as 20 hours. Kemp's ridley turtles stressed from capture in an experimental trawl (7.3 minute forcible submergence) experienced significant blood acidosis, which originated primarily from non-respiratory (metabolic) sources. Visual observations indicated that the average breathing frequency increased from approximately 1-2 breaths/minute pre-trawl to 11 breaths/minute post-trawl (a 5 to 10-fold increase). Given the magnitude of the observed acid-base imbalance created by these trawl experiments, complete recovery of homeostasis may have required 7 to 9 hours (Stabenau et al. 1991). Similar results were reported for Kemp's ridleys captured in entanglement nets, where turtles showed significant physiological disturbance, and post-capture recovery depended greatly on holding protocol (Hoopes et al. 2000).

This long recovery time suggests that turtles would be more susceptible to lethal metabolic acidosis if they experience multiple captures in a short period of time (*in* Lutcavage and Lutz 1997). Presumably, a sea turtle recovering from a forced submergence would most likely remain resting on the surface (given 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. NOAA Fisheries has no information on the likelihood of recapture of sea turtles by HMS pelagic longline fisheries. However, turtles in the Atlantic Ocean have been captured more than once by longliners (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 three or four trips that had the highest number of interactions (Hoey 1998).

Stabenau and Vietti (2003) studied the physiological effects of multiple forced submergences in loggerhead turtles. The initial submergence produced severe and pronounced metabolic and respiratory acidosis in all turtles. Successive submergences produced significant changes in blood pH, P_{CO_2}, and lactate, but as the number of submergences increased, the acid-base imbalances were substantially reduced relative to the imbalance caused by the first submergence. Increasing the time interval between successive submergences resulted in greater recovery of blood homeostasis. The authors conclude that as long as sea turtles have an adequate rest interval at the surface between submergences, their survival potential should not change with repetitive submergences.

Respiratory and metabolic stress from 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. These factors affect the survivability of an individual turtle. 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. Gregory et al. (1996) found that corticosterone concentrations of captured small loggerheads were higher than those of large loggerheads captured during the same season. During the warmer months, routine metabolic rates are higher, so the impacts of the stress from entanglement or hooking may be magnified (e.g. Gregory et al., 1996). In addition, disease factors and hormonal status may 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. Because 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 (Lutz and Lutcavage 1997). Turtles necropsied following capture (and subsequent death) by longliners were found to have pathologic lesions. Two of the seven turtles (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).

Sea turtles also exhibit dynamic endocrine responses to stress. In male vertebrates, androgen and glucocorticoid hormones [corticosterone (CORT) in reptiles] can mediate physiological and behavioral responses to various stimuli, influencing both the success and costs of reproduction. Typically, the glucocorticoid hormones increase in response to a stressor in the environment, including interaction with fishing gear. "During reproduction, elevated circulating CORT levels in response to a stressor can inhibit synthesis of testosterone or other hormones mediating reproduction, thus leading to a disruption in the physiology or behavior underlying male reproductive success" (Jessop et al. 2002). A study in Australia examined whether adult male green turtles decreased CORT or androgen responsiveness to a capture/restraint stressor to maintain reproduction. Researchers found that migrant breeders, which typically had overall poor body condition because they were relying on stored energy to maintain reproduction, had decreased adrenocortical activity in response to a capture/restraint stressor. Smaller males in poor condition exhibited a pronounced and classic endocrine stress response compared to the larger males with good body condition. The authors state: "We speculate that the stress-induced decrease in plasma androgen may function to reduce the temporary expression of reproductive behaviors until the stressor has abated. Decreased androgen levels, particularly during stress, are known to reduce the expression of reproductive behavior in other vertebrates, including reptiles." Small males with poor body condition that are exposed to stressors during reproduction and experience shifting hormonal levels may abandon their breeding behavior (Jessop et al., 2002).

Female green turtles have also been studied to evaluate their stress response to capture/restraint. Studies showed that female green turtles during the breeding season exhibited a limited adrenocortical stress response when exposed to ecological stressors and when captured and restrained. Researchers speculate that the apparent adrenocortical modulation could function as a hormonal tactic to maximize maternal investment in reproductive behavior such as breeding and nesting (Jessop, et al. 2002).

Although a low percentage of turtles that are captured by longline fishermen actually are reported dead, sea turtles can drown from being forcibly submerged. Such drowning may be either "wet" or "dry." With wet drowning, water enters the lungs, causing damage to the organs and/or causing asphyxiation, leading to death. In the case of dry drowning, a reflex spasm seals the lungs from both air and water. 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 depends on the physiological condition of the turtle (e.g. overall health, age, size), time of last breath, time of submergence, environmental conditions (e.g. sea surface temperature, wave action, etc.), and the nature of any sustained injuries at the time of submergence (NRC 1990).

4.2.6 Mortality at Time of Capture

As stated in the previous subsection, relatively few sea turtles captured on longlines are dead as a result of injury or forcible submergence when boated or released. Based on the POP database, only 1.1% of the total number of sea turtles (all species) are dead when brought on board, (see Table 4.4 –Yeung & Garrison summary). This result does not vary much if the data are separated into leatherbacks (1.3% dead) and hardshell turtles (1.0% dead). Based on these data, we believe that turtles are generally hardy enough to survive the initial interaction with longline gear, at least until released by the vessel's crew. We further believe that "immediate" mortality is a rare event occurring with an unusual hooking and/or entanglement or when the turtle's health is already compromised by disease or previous injury. We believe that the 1.3% and 1.0% immediate mortality rates, based on 12 years of observer data from the HMS pelagic longline fishery, are reasonable values for predicting the outcome of future sea turtle-longline interactions.

4.3 Post-Release Mortality

Even though the vast majority of turtles caught with longline gear are released alive, most or all of them will have experienced a physiological injury from forced submergence and/or a traumatic injury from hooking and many may still be carrying penetrating or entangling gear. A number of studies have attempted to assess the post-release mortality in these turtles. Because of limitations in the technology or methods of these studies, the application of their results has not been straight-forward and has generated some controversy, particularly with longline fishermen. Therefore, NOAA Fisheries has developed post-release mortality criteria, based on the best available information on the subject, to set standard guidelines for the post-release mortality estimation.

4.3.1 February 2001 Post-Release Mortality Criteria

In February 2001, NOAA Fisheries established a policy and criteria for estimating sea turtle survival and mortality following interactions with longline fishing gear (NMFS SEFSC 2001; see Table 4.3.1). These criteria were based on the information available at the time on the survival of sea turtles after they were captured and released from longline gear. The June 14, 2001, opinion applied the February 2001 criteria to the available data on hooking location and calculated a net post-release mortality rate of up to 22.8% for leatherbacks and 35.6% for hardshell turtles.

Table 4.3.1. Sea turtle mortality rates based on level and type of interaction with longline fishing gear. Source: NMFS SEFSC 2001

Interaction Type	Release Condition	Injury Categorization	Mortality Rate
Entangled / no hooking	Disentangled	No injury	0%
Entangled / external hooking	Disentangled, no gear	Minor	27%
	Disentangled, trailing gear	Moderate	27%
	Dehooked, no gear	Minor	27%
Hooked in lip (beak) or mouth	Hook left, no gear	Moderate	27%
	Hook left, trailing gear	Serious	42%
	Dehooked, no gear	Moderate	27%
Hook swallowed	Hook left, no gear	Serious	42%
	Hook left, trailing gear	Serious	42%
Turtle Retrieved Dead	- - -	Lethal	100%

4.3.2 January 2004 Post-Release Mortality Criteria

In 2003, the OPR was charged with conducting a review of NOAA Fisheries' February 2001 post-hooking mortality criteria and recommending whether or not, and if so, how, the earlier criteria should be modified. As part of that review, the OPR convened a Workshop on Marine Turtle Longline Post-Interaction Mortality on January 15-16, 2004. During the workshop, 17 experts in the areas of biology, anatomy, physiology, veterinary medicine, satellite telemetry and longline gear deployment presented and discussed the more recent data regarding the survival and mortality of sea turtles subsequent to being hooked by fishing gear. Based on the information presented and discussed at the workshop, and a comprehensive review of all of the information available on the issue, the OPR proposed a series of changes and improvements to the earlier criteria. The new draft criteria are presented in Table 4.3.2. The criteria are still subject to additional review, but nonetheless constitute the best available science on this topic at this time.

Interaction Type/Nature of Interaction Categories
The February 2001 interaction type categories were expanded in the new criteria to better describe the specific nature of the interaction and to reflect the severity of the injury. For example, the February 2001 criteria described two categories for mouth hooking: (1) hook does not penetrate internal mouth structure; and (2) mouth hooked (penetrates) or ingested hook. The new criteria, however, divide the mouth hooking event into three classes: (1) hooked in lower

jaw (not adnexa); (2) hooked in cervical esophagus, glottis, jaw joint, soft palate, or adnexa[1] (insertion point of the hook is visible when viewed through the open mouth); and (3) hooked in esophagus at or below the heart (insertion point of the hook is not visible when viewed through the open mouth). The new criteria also separate external hooking from mouth hooking, add a new category for comatose/resuscitated, and eliminate the February 2001 qualitative injury categories (no injury, minor, etc.), using only the quantitative percentage rates of mortality to describe the impact.

Probable Improvement in Survivorship When Gear Is Removed

The new criteria also account for the probable improvement in survivorship resulting from removal of gear, where appropriate, for each injury. They recognize that in most cases removal of some or all of the gear (except deeply-ingested hooks) is likely to improve the probability of survival. The categories for gear removal are: (1) released with hook and with line that is greater than or equal to half the length of the carapace; (2) released with hook and with line that is less than or equal to half the length of the carapace; and (3) released with all gear removed. Turtles that have all or most of the gear removed are expected to have, on average, a higher probability of survival.

Species Differences

Species differences between hard-shelled turtles and leatherback turtles appear to play a role in post-release survival. The new criteria take these differences into consideration and assign slightly higher rates of post-release mortality for leatherback turtles.

[1] Subordinate part such as tongue, extraembryonic membranes

Table 4.3.2. Criteria for assessing marine turtle post-interaction mortality after release from longline gear. Percentage rates of mortality are shown for hardshelled turtles, followed by percentages for leatherbacks (in parentheses).

Nature of Interaction	**Released with hook and with line greater than or equal to half the length of the carapace**	**Release with hook and with line less than half the length of the carapace**	**Released with all gear removed**
	Hardshell (Leatherback)	Hardshell (Leatherback)	Hardshell (Leatherback)
Hooked externally with or without entanglement	20 (30)	10 (15)	5 (10)
Hooked in lower jaw (not adnexa[1]) with or without entanglement	30 (40)	20 (30)	10 (15)
Hooked in cervical esophagus, glottis, jaw joint, soft palate, or adnexa (and the insertion point of the hook is visible when viewed through the mouth) with or without entanglement	45 (55)	35 (45)	25 (35)
Hooked in esophagus at or below level of the heart (includes all hooks where the insertion point of the hook is not visible when viewed through the mouth) with or without entanglement	60 (70)	50 (60)	n/a[2]
Entangled Only	Released Entangled 50 (60)		Fully Disentangled 1 (2)
Comatose/resuscitated	n/a[3]	70(80)	60(70)

[1] Subordinate part such as tongue, extraembryonic membranes

[2] Per veterinary recommendation hooks would not be removed if the insertion point of the hook is not visible when viewed through the open mouth.

4.4 Extent of the Effects – Past Sea Turtle Interactions in the Longline Fishery

Observations of sea turtle 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. In 1999, the 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 for loggerheads, over the period 1992 - 1999, was 7,891 (95% CI = 3,835 - 18,805) (See NMFS SEFSC 2001 for full discussion of the method). Totals for 1999 estimated 991 loggerhead sea turtles incidentally taken (95% CI = 510 - 2,089). For leatherback sea turtles, an estimated incidental take of 6,363 turtles (95% CI = 2,491 - 17,613) occurred in the fisheries between 1992-1999. For 1999, an estimated 1,012 leatherbacks were taken (95% CI = 410 - 2,786). Of these estimated 7,891 loggerhead and 6,363 leatherback turtles captured by the HMS pelagic longline fisheries from 1992-1999, 66 loggerhead and 88 leatherbacks were estimated to have been released dead (NMFS SEFSC 2001). Of the 991 loggerhead and 1,012 leatherbacks estimated from observer records to have been captured by the HMS pelagic longline fisheries from 1999, 23 loggerhead were estimated to have been released dead; there were no leatherbacks released dead that year. These data are important as they were the latest data available during the previous consultation on the HMS pelagic longline fishery.

Since 1992, green, hawksbill, and Kemp's ridley sea turtles have been infrequently reported by the POP. Annual take estimates for these species have ranged from 1 to 87, usually based on the reported catch of 1 or 2 individuals. More than likely, these are misidentified records of loggerhead turtle captures (NMFS SEFSC 2001). Loggerhead turtles are the most common hard-shelled turtles taken in the fishery (Hoey 1998; Witzell 1999). As observer experience and training in the POP has improved with time, the reported number of reported green, hawksbill, and Kemp's ridley turtles has declined.

Since the June 14, 2001, opinion and the implementation of the HMS pelagic longline closed areas, a new report of estimated sea turtle takes has been generated for the years 2001 and 2002 (Garrison 2003a). This report updates the previous estimates of interactions in the HMS pelagic longline fishery. The bycatch estimates for 2002 in this updated report meet the criteria established in NOAA Fisheries' report, "National Approach to Standardized Bycatch Monitoring Programs," (NMFS 2003) with a coefficient of variation (cv) less than the specified precision level goal of 20-30% for protected species.

In the most recent report of sea turtle interactions in the HMS pelagic longline fishery, Garrison (2003a) estimates bycatch of sea turtles by using observer data including those interactions occurring during the NED experimental fishery. The methodology and approach were similar to that used in previous assessments of sea turtle interactions in the HMS pelagic longline fishery. The main difference from the previous assessment by Yeung (1999), which pooled data across areas to fill empty strata, is that Garrison (2003a) incorporated the mean bycatch rate of interactions observed in the quarter-area stratum across the previous five years. This was done because it is believed that the population sizes of long-lived species, such as marine mammals and sea turtles, are less likely to undergo large inter-annual fluctuations. Therefore, large inter-annual differences in bycatch rate are not as important relative to seasonal (quarter) and geographic (area) effects. No bycatch estimates were incorporated into the analysis when there was no historical observer coverage information within the previous five years. This approach avoided the potential biases associated with pooling across geographical strata, while allowing bycatch estimates for the majority of unobserved strata. However, it should be noted that in the cases where no bycatch estimate was incorporated, no takes are assumed to occur, and these strata have been highlighted as potential sources of underestimating bias.

Observed sea turtle captures in the HMS pelagic longline fishery in 2001 and 2002 (Figure 4.4) illustrate that take was higher than predicted in the June 14, 2001, opinion. Garrison (2003a) estimated leatherback sea turtle incidental catch in the HMS pelagic longline fishery to have been 1,208 (95% CI = 851-1716) in 2001 and 962 (95% CI = 708-1308) in 2002. Garrison (2003a) estimated that there were 312 (95% CI = 155-629) loggerhead sea turtles incidentally caught by the HMS pelagic longline fishery in 2001 and 548 in 2002. Thus, the estimated historical total number of loggerhead sea turtles caught between 1992-2002, by the U.S. pelagic longline fishery, is 10,034, of which 81 were estimated to be brought to the vessel already dead (Table 4.4). The estimated historical total number of leatherback sea turtles caught between 1992-2002, by the U.S. pelagic longline fishery, is 9,302, of which 121 were estimated to be brought to the vessel already dead (Table 4.4). This figure does not account for post-release mortalities. The total number of observed leatherback interactions in 2001, including the NED experiment, was 273. The total number of observed interactions for 2002, again including the NED experiment, was 335. Interactions in the NED experiment are not shown in Table 4.4.

One loggerhead turtle was observed to have been killed during 2001 and one leatherback was observed dead during 2002. In 2003, one leatherback sea turtle was observed dead and no loggerhead sea turtles were observed dead (Garrison, personal communication, 2004). Results corroborate earlier data that most leatherback sea turtles are hooked externally, typically in the shoulder or front flipper, whereas loggerhead turtles more often swallowed the hook or were hooked in the mouth region. In 2001, the highest number of leatherback interactions occurred during Quarter 3 in the Florida East Coast (FEC) region (254 estimated interactions), and in the Gulf of Mexico (GOM) statistical area during the 2nd and 3rd quarters (180 and 157 estimated takes, respectively), with additional high numbers of interactions occurring in the South Atlantic Bight (SAB) and Mid-Atlantic Bight (MAB) regions. The highest number of loggerhead turtle interactions occurred during the 3rd quarter in the NEC statistical areas (106 estimated), and 4th quarter in the NED statistical area (97. Note all takes from the NED are observed, not estimated). In 2002, the highest number of leatherback sea turtle interactions occurred during the 2nd- 4th quarters again in the GOM (Garrison 2003a). The estimated number of interactions for the GOM during 2002 was 694.6. The highest number of loggerhead turtle interactions occurred during the 2nd quarter in the NEC and GOM statistical areas.

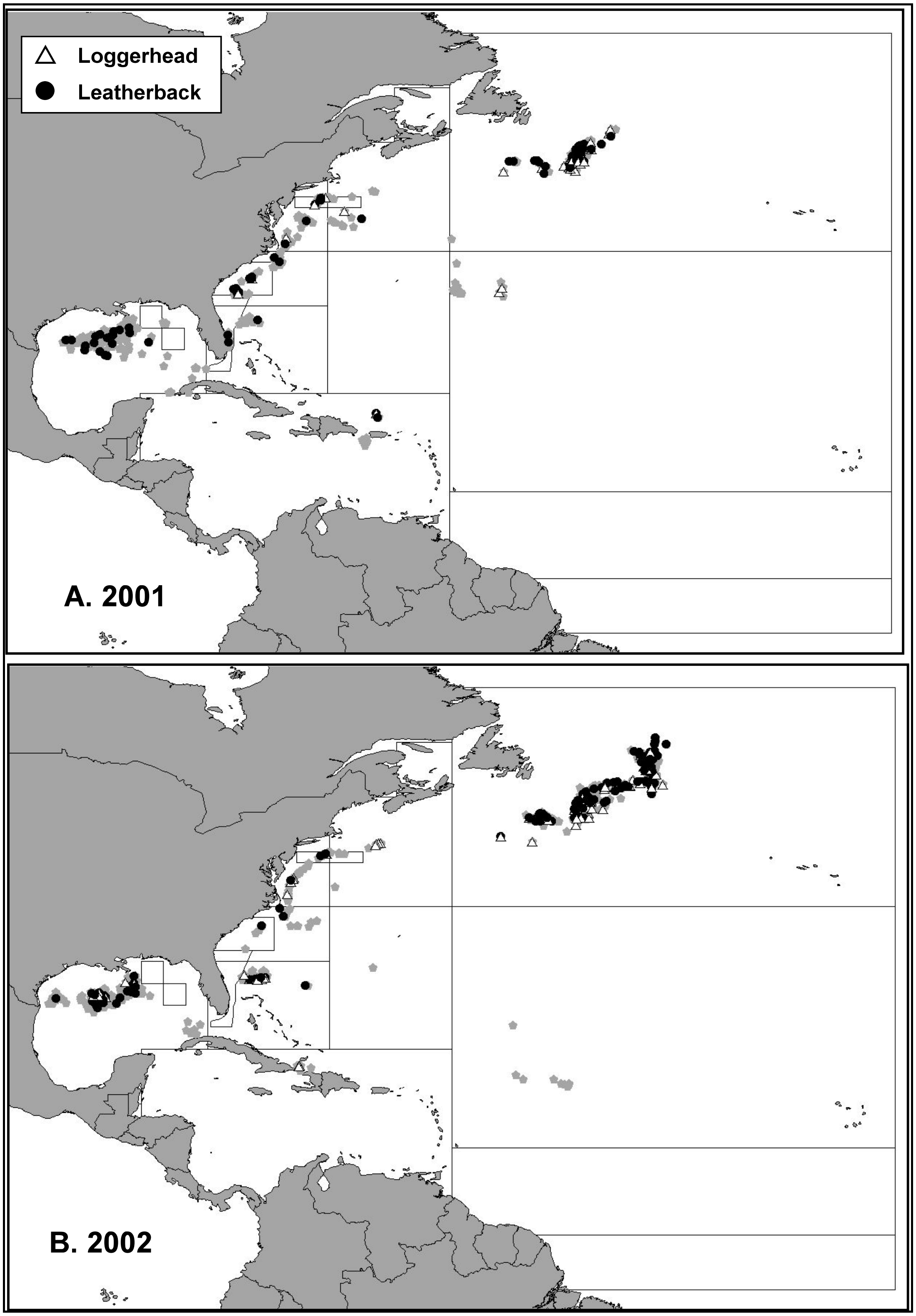
During the 3-year cooperative research study to develop gear measures for reducing sea turtle interactions (conducted in the NED statistical sampling area) there were incidental captures of sea turtles. In the 2001 NED experiment, with 100% observer coverage, there were 186 sets made by 8 vessels that incidentally caught 142 loggerhead and 77 leatherback sea turtles with no sea turtles released dead. In 2002, with 100% observer coverage, there were 501 sets made by 13 vessels that incidentally caught 100 loggerhead and 158 leatherback sea turtles. In 2003, there were 539 sets made by 11 vessels that incidentally caught 92 loggerhead sea turtles, 79 leatherback sea turtles, and 1 olive ridley sea turtle. No sea turtles were released dead in the NED experiment.

Table 4.4. Annual Estimates of Total Marine Turtle Bycatch and the Subset that were Dead When Released in the U.S. Pelagic Longline Fishery.
Source: NMFS SEFSC 2001 (1992-1999 data); Yeung. 2001 (2000 data); Garrison, 2003a (2001-2002 data).

Species	Loggerhead		Leatherback		Green		Hawksbill		Kemp's Ridley		Unidentified		Sum Total
Year	Total	Dead*	Total	Dead*	Total	Dead*	Total	Dead*	Total	Dead*	Total	Dead*	
1992	293	0	914	88	87	30	20	0	1	0	26	0	1,341
1993	417	9	1,054	0	31	0					31	0	1,533
1994	1,344	31	837	0	33	0			26	0	34	0	2,274
1995	2,439	0	934	0	40	0					171	0	3,584
1996	917	2	904	0	16	2					2	0	1,839
1997	384	0	308	0			16	0	22	0	47	0	777
1998	1,106	1	400	0	14	1	17	0			1	0	1,538
1999	991	23	1,012	0							66	0	2,069
2000	1,256	0	769	0							128	0	2,153
2001	312	13	1,208	0							0	0	1,520
2002	575	2	962	33							50	0	1,587
Total	**10,034**	**81**	**9,302**	**121**	**221**	**33**	**53**	**0**	**49**	**0**	**556**	**0**	**20,215**

* Does not account for fishing related mortality that may occur after release.

Figure 4.4. Marine turtle takes during pelagic longline fishing effort during (A) 2001 and (B) 2002. Observed sets with no turtle takes are indicated by light circles.



4.5. Extent of the Effects – Anticipated Future Sea Turtle Interactions

The proposed action would, in part, increase the 2003 North Atlantic swordfish quota from 2,951 mt ww to 3,877 mt ww and increase the quota in2004 and 2005 to 3,907 mt ww. If the increase in available quota triggers an increase in fishing effort, that would then increase the incidental catch of protected species. Currently, HMS Division believes it is unlikely that effort will increase. For the past several years, the level of effort in the HMS pelagic longline fishery has been steadily declining. Additionally, a number of restrictions, such as limited access and time and area closures, have been placed on the pelagic longline fleet. This declining effort has led to under-harvests: despite the existing 2,951 mt ww swordfish quota, only 1,025.4 mt ww was harvested in the 2001 fishing year. We agree with HMS Division that the level of effort in the fleet is unlikely to increase despite the change in quota. Therefore, there should not be an increase in the incidental take of protected species by the HMS pelagic longline fleet.

In the June 14, 2001, opinion, NOAA Fisheries used the sea turtle bycatch estimates from the most recent year available (1999). Although inter-annual variation in the bycatch estimates has been high, NOAA Fisheries believes using data from a single, recent year is more likely to be representative of the level of interactions in future years than using long-term averages. Long-term averages may include underlying changes in the level and distribution of effort, fishing tactics, and possibly the distribution of sea turtles. For example, HMS pelagic longline fishery time-area closures went into effect in 2000 and 2001. These closures have changed fishing effort levels and the distribution of that effort. Therefore, it would be impossible to rely on pre-2002 take estimates for future projections.

In this opinion, we take the same approach, and use the 2002 pelagic longline fishery take estimates from Garrison (2003a), summarized in section 4.4. We believe this information is representative of the level of take expected if the status quo were maintained and none of the proposed rule provisions were enacted. The 2002 data represents the most complete information available (observer data, but not effort data, are available for 2003), and the fishery is not expected to significantly change in scope or distribution in the near term. To assess the effects of reopening the NED, we concur with and rely on the approach used in the DSEIS, which uses the observed catch per unit effort (CPUE) in the NED experiment and multiplies it by the amount of effort anticipated to return to the NED.

For the hardshell turtles, other than loggerheads, it is difficult to make predictions about future levels of interactions. The reported interactions are very low, usually 1 or 2 per year at most, and often none per year. Also, the existing reports from the POP may include species misidentifications. Still, we cannot discount the possibility of rare or “out of habitat” interactions. For example, the NED experiment, with 100% observer coverage, did capture one confirmed olive ridley and one confirmed Kemp’s ridley in 2003, and other fisheries have had similar unexpected interactions (e.g., hawksbill turtles in the North Carolina winter trawl fishery and in the North Carolina fall, estuarine, gillnet fishery). Thus, the observed take of 1 or 2 individuals per year, while not a regular event, would not be surprising. Based on previous extrapolation results, this rate would correspond to an estimated take of roughly 35 turtles per year in the entire HMS pelagic longline fishery .

In this sub-section, we discuss the outcome of the NED experiment and how those results apply to the future anticipated effects of the action; explain how we chose which results were used to calculate the anticipated effects; show how the calculations were made and the results of those calculations; and then calculate and discuss the expected mortality that would be associated with those takes.

4.5.1 Bycatch Reduction Expected from the Proposed Action

In 2001, the SEFSC launched a cooperative research program to study means to reduce the catch rates of sea turtles in the HMS pelagic longline fishery and to reduce the mortality of those captured sea turtles. The research spanned three fishing seasons in the NED, an area with historically high sea turtle capture rates. These high catch rates offered the opportunity to generate statistically valid results when testing sea turtle bycatch reduction measures. The NED experiment was a substantial improvement over previous efforts by NOAA Fisheries to determine the factors affecting sea turtle catch rates in the HMS pelagic longline fishery. Previous efforts had relied on post-hoc analyses of observer data that were confounded by the autocorrelations of the possible factors in the fishery. In contrast, the NED research was a true experiment that compared experimental versus control treatments within and across sets and used a rigorous statistical approach to more definitively determine the factors affecting sea turtle bycatch rates.

The research focused on modifying the actual fishing gear rather than efforts to change the timing or location of fishing. Gear modification measures are believed to be the most easily and consistently adopted measures throughout the domestic and international longline fleets and therefore are expected to achieve the greatest conservation benefit for sea turtles. Although a number of gear modification measures have potential for bycatch reduction, the SEFSC selected measures for the NED experiment that appeared to have high bycatch reduction potential and that could be combined into a single experiment, thus allowing the simultaneous testing of multiple factors. In the final two years of the experiment, the SEFSC focused its research on terminal gear characteristics only: hook type, bait type, and their interaction.

Between 2001 and 2003, nine potential mitigation techniques were evaluated during 1,214 research sets, with a total of 1,169,864 hooks fished. Data were collected to evaluate the effectiveness of the mitigation measures and to investigate variables that affect sea turtle interaction rates with pelagic longline gear. The results of the research in 2001 indicate that a significant reduction in loggerhead catch may be achieved by reducing daylight soak time, but in 2002 only total soak time was significant. Blue-dyed squid bait appeared to have no effect on sea turtle interactions. Moving hooks 20 fathoms away from float lines did not reduce sea turtle interactions and appeared to have increased leatherback interactions. 18/0 circle hooks and mackerel bait were both found to significantly reduce loggerhead and leatherback sea turtle interactions when compared with industry standard J-hooks and squid bait, but mackerel had no significant effect over squid when circle hooks were used. Also, circle hooks significantly reduced the rate of hook ingestion by the loggerheads, reducing the post-hooking mortality associated with the interactions. The combination of 18/0 circle hooks and mackerel bait was found to be the most efficient mitigation measure for loggerhead turtles. The relationship was less clear for leatherback sea turtles, with squid bait and circle hooks showing the highest reduction rates in some situations (Table 4.5.1). The effect of offset versus non-offset hooks may play a role in those differences, however, in all cases 18/0 circle hooks provide a substantial reduction in interactions between sea turtles and longline fishing gear versus J-hooks. Mackerel bait was found to be more efficient for swordfish than squid bait, and circle hooks were more efficient for tuna than J-hooks (Watson et al. 2004a, Shah et al. 2004).

In anticipation of the need for mitigation measures in tuna directed fisheries, research was initiated by NOAA Fisheries late in 2003 comparing 16/0 circle hooks with 18/0 circle hooks. Only a small number of sets (n=29) could be completed at the time, so the differences could not be assessed using those data. Information from other studies have shown that there is no difference in interaction rates between 9/0 J-hooks and 16/0 circle hooks for loggerhead sea turtles (Bolten et al. 2002; Javitech 2002). Other data (Garrison 2003b) from the observer program show that no loggerhead turtles have been observed captured on circle hooks in the Gulf of Mexico (total number of observed circle hook sets = 416). Additionally, it is known that smaller J-hooks (7/0 and 8/0) are frequently used in the Gulf of Mexico tuna fishery, and are expected to have a higher catch rate for turtles than the 9/0 J-hook, but the only experimental data available compares the 16/0 circle hook with the larger 9/0 J-hook (Watson et al. 2004b). However, despite these caveats, we use the most protective, conservative assumptions in our analysis, and therefore the take rate for loggerheads on 16/0 circle hooks are considered the same as that for the 9/0 J-hooks (therefore no take reduction attributed to use of 16/0 circle hooks). Leatherback interactions are primarily foul hooking, and therefore the use of 16/0 circle hooks instead of J-hooks is expected to reduce the take of this species. NOAA Fisheries data are primarily for the 18/0 and 20/0 circle hooks, but there is every reason to believe that a 16/0 circle hook would be just as effective in reducing leatherback captures by foul hooking, if not more so (because of the smaller gap between the shank and point) (Watson et al. 2004b). The non-offset 16/0 circle hook with squid is therefore considered to have the same bycatch reduction for leatherback sea turtles as the non-offset 18/0 circle hook with squid.

HMS Division is now considering, as part of the proposed action, requiring the use of specific hook and bait combinations in the HMS pelagic longline fishery, based on the results of the NED experiment and other available information. The allowable hook and bait combinations in the longline fishery would be:

<u>NED pelagic longline fishery</u>-
18/0 or larger circle hook with an offset not to exceed 10 degrees. Only mackerel and squid baits may be possessed and/or utilized with allowable hooks.

Atlantic/Gulf of Mexico pelagic longline fishery outside of the NED-
16/0 or larger non-offset circle hooks and/or 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Only whole finfish and squid baits may be possessed and/or utilized with allowable hooks.

We expect that these hook and bait combinations will achieve the same levels of sea turtle bycatch reduction demonstrated in the NED experiment when used throughout the longline fishery (with the exception of 16/0 circle hooks and loggerheads, as discussed above). For all of the hooks (except 18/0 non-offset circle hooks for leatherbacks), squid bait is believed to be the worst-case bait for sea turtle captures. There were significant reductions in both loggerhead and leatherback catch rates when squid bait was switched for mackerel bait on standard J-hooks. Additionally, feeding studies involving captive loggerhead turtles show that the turtles usually attempt to gulp down squid baits whole, taking any hook that may be embedded. When hooks are baited with fish, a loggerhead usually tears off discrete bites and may be able to scavenge a fish bait without swallowing or even taking the hook into its mouth. Feeding behavior can also be impacted by how the hook is baited (e.g. single hooked versus threaded). Garrison (2003b) reported that use of fish bait resulted in lower turtle capture rates than squid bait, although numerous other fishing variables were not controlled for. We believe it is a reasonable, conservative assumption that equivalent circle hooks baited with whole fish will have at least the same level of sea turtle bycatch reduction as the same circle hooks baited with squid. This is supported by the reduction percentages shown in Table 4.5.1.

Shah et al. (2004) fitted generalized linear models to investigate the relationship between the catch rate (or catch probability) and explanatory variables such as hook type, sea surface temperature, day light soak time, total soak time, vessel effect, and pairing effect in case of matched-paired hook types per set.

Table 4.5.1 Sea Turtle Bycatch Reduction Rates for Hook and Bait Combinations. All reductions are compared to industry standard J-hook and squid bait combination. Sources: Shah et al. (2004), Watson et al. (2003), Watson et al. (2004a), Bolten et al. (2002)

Species	Year	Treatment	Reduction Rate (%)	Significant Effect of Year
Loggerhead	2002	Non-offset 18/0 circle hook with squid bait	87.5	Yes (p=0.0002)
Loggerhead	2003	Non-offset 18/0 circle hook with squid bait	64.6	
Loggerhead	2002	10 Offset 18/0 circle hook with mackerel bait	90.4	No (p=0.3027)
Loggerhead	2003	10 Offset 18/0 circle hook with mackerel bait	85.8	
Loggerhead	N/A	Non-offset 16/0 circle hook with squid bait	0	N/A
Leatherback	N/A	Non-offset 16/0 circle hook with squid bait	63.9 (est.)	N/A
Leatherback	2002	10 Offset 18/0 circle hook with squid bait	50.0	N/A (only tested in 2002)
Leatherback	2002	Non-offset 18/0 circle hook with squid bait	63.9	Yes (p=0.0017)
Leatherback	2003	Non-offset 18/0 circle hook with squid bait	89.7	
Leatherback	2002	10 Offset 18/0 circle hook with mackerel bait	65.4	Yes (p=0.0258)
Leatherback	2003	10 Offset 18/0 circle hook with mackerel bait	64.8	

A notable aspect of Shah et al.'s results is the significant effect of year on the sea turtle reduction rates. The same significant effect of year was found for target species catch rates. Because the reduction rates associated with the hook and bait combinations varied significantly between years, we do not believe it is appropriate to combine the two years' results (combined results were presented in Shah et al. {2004]) when making forecasts about future years. The significance of year suggests the effect of inter-annual environmental variation or some other factors not yet understood, which we cannot predict. To be conservative in anticipating a benefit from the proposed action, therefore, we will base our projections of bycatch reduction for each species and hook and bait combination on the lower value of the two years.

The proposed action includes various hook and bait combinations for fishermen to select. We expect the non-offset hook with squid or finfish combination to be used when targeting tunas (16/0) or tuna-swordfish mixed (16/0 and/or 18/0), and the 18 /0 offset hook with mackerel combination to be used when targeting swordfish. We cannot predict with any certainty the actual mix of hook and bait combinations that will be used in the fishery. In anticipating a conservative benefit from the proposed action, we will base our projections of bycatch reduction for each species on the value for the less effective of the two hook and bait combinations. For leatherbacks we used the bycatch reduction value for the 10 degree offset 18/0 hook with squid bait in both the NED and non-NED fisheries. This results in a take reduction of 50% compared to the 2002 bycatch levels using the base configuration of a 9/0 J-hook with squid. For loggerheads, we used the bycatch reduction value from the non-offset 18/0 hook with squid or finfish combination for the NED (64.6% reduction) and the 16/0 non-offset circle hook with squid for the areas outside of the NED (no reduction). For green, hawksbill, Kemp's ridley and olive ridley turtles, we have no direct information, but the effects of varying hook type are probably more similar to loggerheads. Also, because we anticipate, at most, only a few observed catches of these other hardshell species per year, we are not applying a further bycatch reduction factor to these rare events, based on the hook and bait types in the proposed action.

4.5.2 Calculation of Anticipated Takes

The next step in determining the effects of the proposed action was to utilize the analyses described above to calculate the total expected take that would occur on an annual basis if the proposed action was implemented. Using total estimated take for 2002, a reduction was then applied based on the proposed hook and bait requirement. The estimated annual take from the proposed action to reopen the NED was then added to get the total take estimate.

Estimated annual take was calculated separately for 2004 and for the future. A separate estimate for 2004 was needed because the proposed action would not be implemented, and any reductions in take resulting from the action, would not occur until the second half of the year. Because fishing effort is often not uniform throughout the year, Garrison's (2003) effort data by set was used to determine what percentage of effort occurred in the first two quarters of 2002 versus the last two quarters. When adding in the NED take estimates, the entire yearly estimate was added. The majority of the effort in the NED is expected to take place in the second half of the year, but the actual percentage of effort that can be expected is unknown. Therefore, we have taken a conservative approach and added in the total annual estimate for 2004. The NED take estimates are taken from the DSEIS and were calculated based on the CPUE observed in the NED experiment with the experimental hook and bait combinations and the amount of annual effort that the HMS division anticipates to return to the NED.

The total annual take estimation formulas are as follows:

<u>2004 take estimate</u>= (2002 take estimate)(% of effort in 1st two quarters) + (2002 take estimate)(% of effort in 2nd two quarters)(100% - estimated % reduction from use of circle hooks)

+ (estimated NED takes per HMS analysis)

2005 and beyond take estimate = (2002 take estimate)(100% - estimated % reduction from use of circle hooks) + (estimated NED takes per HMS analysis)

The resulting take estimates are:

2004
Leatherback = (962)(49%) + (962)(51%)(100 % - 50%) + 88 = **805**
Loggerhead = (575)(49%) + (575)(51%)(100%-0%) + 24 = **599**

2005 and beyond
Leatherback = (962)(50%) + 107= **588**/year

Loggerhead = (575)(100%) + 60= **635**/year

For green, hawksbill, Kemp's ridley and olive ridley turtles, we anticipate an estimated take of up to 35 individuals from these four species combined in any year.

4.5.3 Mortality Estimates

To estimate the total impact of the HMS pelagic longline fishery under the proposed action, it is necessary to estimate the future mortality associated with those takes to better understand the impact to the species. We utilized the January 2004 post-release mortality ratios presented earlier in Table 4.3.2, along with sea turtle bycatch and release data from the NED experiment and non-NED observer data. In some situations, the observer data did not clearly fit into one of the interaction categories. Following the guidance provided in Epperly and Boggs (2004), those takes were included in the most conservative *category*. This captured the highest likelihood of mortality and the assumption that the take was a deep ingestion. Data for all of these analyses come from the 2002-2003 fishing season as they are the most recent and complete data available. Overall mortality ratios are dependent upon both the type of interaction (*i.e.*, where hooked, entangled or not, comatose or dead upon retrieval) and the gear that was left following the release (hook remaining, amount of line remaining, entangled or not). Therefore, in addition to how the turtle interacted with the gear, the experience, ability, and willingness of the crew to remove gear, and the available gear-removal equipment are very important factors in the post-release mortality ratios.

4.5.3.1 NED Experiment – Interaction and Gear Removal Results

Observer data from the NED experiments were compiled into the new post-release mortality categories to determine an overall mortality ratio for J-hooks and circle hooks in those experiments (Epperly and Boggs 2004). Using J-hooks in the NED experiment (Table 4.5.3.1.A), a total of 147 leatherback and 131 loggerhead sea turtles were captured. Based upon the amount of gear that was removed prior to release, and the type of interactions that occurred in those studies, the overall mortality ratio was calculated to be 0.138 (13.8%) for leatherbacks and 0.330 (33%) for loggerheads. When using circle hooks in the experiment (Table 4.5.3.1.B), a total of 103 leatherback and 46 loggerheads were captured, with morality ratios of 0.131 (13.1%) and 0.170 (17%), respectively. The benefit of using circle hooks versus J-hooks was more evident for loggerheads, where there was a substantial drop in mortality. The mortality benefit to loggerheads is because circle hooks are more likely to result in mouth hooking and less deep ingestion than the J-hooks, and that loggerhead sea turtles are known to actively feed on baited longline hooks. There was little to no mortality benefit to leatherback sea turtles when interactions occurred because 90% of the interactions, external foul hooking and entanglement, remain the same regardless of hook type. The NED experiment had 100% observer coverage, as well as captains and crew that were well trained, well equipped, and experienced in gear removal from sea turtles. All of this information is based upon 18/0 circle hooks. The use of 16/0 circle hooks is assumed to result in the same degree of hook removal ability and post-release mortality as the 18/0 hook. Post hooking mortality is impacted by hooking location, and the 16/0 is known to hook in similar locations to the 18/0 circle hook (Javitech Ltd. 2002; Watson et al. 2004b). The mortality ratios attained for circle hooks in the NED experiment represent the best reasonably expected (under real fishing conditions) mortality ratio for the HMS pelagic longline fishery under the proposed circle hooks and gear removal equipment requirements.

4.5.3.2 Non-NED Observed Fishery – Interaction and Gear Removal Results

To better understand how the current HMS pelagic longline fishery may be impacting sea turtle populations, we determined mortality ratios based upon 2002-2003 observer data outside of the NED experiment, and the post-release mortality guidelines (Table 4.5.3.2). The current HMS pelagic longline fishery almost exclusively uses J-hooks; therefore, the calculated mortality ratios assume the use of J-hooks. In observed sets of the non-NED fishery during 2002-2003, a total of 116 leatherback and 95 loggerhead sea turtles were incidentally captured. Based on the observer data, these takes were separated into the appropriate post-release mortality categories. The resulting post interaction mortality ratios were 0.319 (31.9%) for leatherback and 0.404 (40.4%) for loggerhead sea turtles.

It is important to note that the data for the non-NED analysis is based on 12 vessels of which 10 participated in the NED cooperative experiment; thus, NOAA Fisheries believes that this information may not be representative of the entire fleet. The vessels on which the analysis is based were not only equipped with all the sea turtle mitigation gear, but also had been trained in sea turtle mitigation techniques and were supportive of the NED research project objectives to reduce sea turtle mortality. However, some of the benefit of experienced, well-equipped crews is countered by the fact that this fishery used J-hooks, which are prone to hooking in manners resulting in higher mortality than circle hooks. Additionally, a sizeable, but undetermined, portion of the fishery used relatively small 7/0 and 8/0 J-hooks, which are even more prone to deep ingestion. In the NED experiment with J-hooks (which only used larger 9/0 hooks) less than 34% (44 of 131) of loggerhead sea turtles had deeply ingested hooks, while over 47% (45 of

95) in the non-NED fishery had deeply ingested hooks. There was also a large difference in leatherback interactions, with 11% (13 of 116) in the non-NED fishery having a deeply ingested hook (category IV), whereas no deep ingestion occurred for leatherback sea turtles in the NED experiments despite their use of both J-hook (n=147) and circle hook (n=103). In the non-NED data, many of the leatherback observations were listed as "unknown if hooked" or "hooking location unknown." To be conservative, these were placed into the category IV. In most cases, they were probably not deeply ingested because that is a very rare occurrence with leatherback sea turtles; therefore this represents a very conservative overestimate of leatherback post-release mortality

4.5.3.3 Anticipated Interaction and Gear Removal Rates

To examine the reasonably expected levels of mortality that would occur under the proposed action, we applied the levels of gear removal that occurred outside of the NED to the data which best represents the expected interaction types under the proposed rule (the NED circle hook data). To estimate the level of gear removal that occurs in this fishery, the ratio of gear removal (hook and line greater than ½ carapace length remaining, etc.) for each interaction type (external, lower jaw, etc.) was determined for the non-NED observer data. The NED circle hook data were then redistributed within each interaction category according to the proportion of gear removal from the non-NED fishery. Again, these results indicate the mortality ratios that could be expected if circle hooks are used throughout the fishery and gear removal occurs to the degree it had in the 2002-2003 non-NED fishery. The resulting overall mortality ratios were 0.328 (32.8%) for leatherback sea turtles and 0.218 (21.8%) for loggerhead sea turtles (Table 4.5.3.3). These values indicate that, compared to the recent non-NED fishery, the mortality levels for loggerhead sea turtles would drop from 40.4% to 21.8% . This can be attributed to the change from J-hooks to circle hooks in the fishery. The leatherback mortality ratio would remain approximately the same as the fishery prior to enactment of the circle hook requirement (32.8% vs. 31.9%); again, because the type of interaction does not change as the hook-type changes.

4.5.3.4 Anticipated Lethal Takes

The mortality ratios calculated above were then used to estimate the number of lethal takes resulting from the fishery under the proposed action by multiplying the estimated total takes by the mortality ratios. The least conservative approach would be to apply the mortality ratio for the NED circle hook data. This mortality ratio relies on the fishery being required to use circle hooks, to have all required gear-removal equipment on board, and to have the experience and willingness to use the equipment, as was the case in the NED experiment. A more conservative estimate, which was used for this assessment, is obtained by applying the mortality estimates based on non-NED removal proportions and NED circle hook interactions. This is based on the fishery being required to use circle hooks, but removing gear at a rate similar to that occurring fishery-wide prior to the proposed action. Prior to calculating the post-release mortality, immediate mortality (dead when brought aboard) must be considered. As explained in section 4.2.6, 1.3% of leatherbacks and 1.0% of hardshell turtles observed in the longline fishery over 12 years were dead upon gear retrieval. Those percentages are applied to the expected total take for the purposes of this opinion, although they are probably overestimates because the circle hooks required in the proposed action are anticipated to decrease immediate mortality. For 2004 only, where the rule will only be in effect for the second half of the year, the mortality ratios in Table 4.5.3.2 were applied to the take for the first half of the year, with the take for the second half of the year being treated the same as that for subsequent years.

The 2004 mortality estimates are as follows:

-For leatherback sea turtles, based on estimates of 471 pre-rule takes, 334 post-rule takes, 1.3% immediate mortality (10 turtles), and the mortality ratios discussed above, the mortality in 2004 is expected to be **266** individuals.

-For loggerhead sea turtles, based on estimates of 282 pre-rule takes, 293 post-rule takes, 1.0% immediate mortality (6 turtles), and the mortality ratios discussed above, the mortality in 2004 is expected to be **182** individuals.

For subsequent years, mortality is estimated as follows:

-For leatherback sea turtles, based on 588 total annual takes after the proposed action goes into effect, 1.3% immediate mortality (8 turtles), and the mortality ratios discussed above, total annual mortality is expected to be **198** individuals.

-Loggerhead sea turtle annual mortality, based on 635 total annual takes, 1.0% immediate mortality (6 turtles), and the mortality ratios previously discussed, would be **143** individuals.

For greens, hawksbills, Kemp's ridleys and olive ridleys, based on 35 total annual takes, and the mortality rations previously discussed, annual mortality would be up to **8** individuals from these four species combined in any year.

Table 4.5.3.1.A. Mortality ratio data for turtles caught on swordfish-style gear using J hooks by NED research fleet in 2002-2003 [based on SEFSC summaries of hooked turtles and estimates of turtles entangled only (not hooked)*]

		Released Alive															
		Hooked with or without entanglement											V. Entangled only*		VI. Comatose and resuscitated		
		I. Externally			II. Lower jaw			III. Upper mouth/throat			IV. Deep esophagus						
Species	Total	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	All gear re-moved	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	All gear re-moved	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	All gear re-moved	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	releas-ed en-tangled	disen-tangled	Hook & line <.5 cp. len.	All gear re-moved	Dead
Leatherback	147	22	30	60	0	1	0	0	1	2	0	0	2	29	0	0	0
Loggerhead	131	0	0	17	0	0	2	0	36	30	0	44	0	2	0	0	0
All species	278	22	30	77	0	1	2	0	37	32	0	44	2	31	0	0	0
Mortality ratio:																	
Hardshells		0.20	0.10	0.05	0.30	0.20	0.10	0.45	0.35	0.25	0.60	0.50	0.50	0.01	0.70	0.60	1.00
Leatherbacks		0.30	0.15	0.10	0.40	0.30	0.15	0.55	0.45	0.35	0.70	0.60	0.60	0.02	0.80	0.70	1.00
Overall Ratio:		Calculated mortality for each cell in the matrix (no. turtles times mortality ratio)															
Leatherback	0.138	6.6	4.5	6	0	0.3	0	0	0.45	0.7	0	0	1.2	0.58	0	0	0
Hard shell**	0.330	0	0	0.85	0	0	0.2	0	12.6	7.5	0	22	0	0.02	0	0	0
All species	0.228	6.6	4.5	6.85	0	0.3	0.2	0	13.05	8.2	0	22	1.2	0.6	0	0	0

*Estimates of the ratio of entangled only to total takes were obtained from a subsample of sets where all turtles were caught on J hooks. This ratio was used to estimate entangled only takes from the hooked takes on J hooks from 2002-2003. The ratio of released entangled leatherbacks to total entangled was 0.05 for all baits and hooks in 2002-2003. This ratio was used to estimate the number of released entangled leatherbacks for J hooks. No loggerheads were ever released entangled. All other numbers of turtles by categories are totals from the NED observer data as summarized by Epperly (SEFSC).

**All hardshell turtles assumed to have a mortality ratio like loggerheads, since there were too few NED data on other spp to make direct estimates for olive ridley or green turtles

Table 4.5.3.1.B. Mortality ratio data for turtles caught on swordfish-style gear using 18/0 and 20/0 circle hooks by NED research fleet in 2002-2003 [(based on SEFSC summaries of hooked turtles and estimates of turtles entangled only (not hooked)*]

Species	Total	Released Alive															Dead
		Hooked with or without entanglement											V. Entangled only*		VI. Comatose and resuscitated		
		I. Externally			II. Lower jaw			III. Upper mouth/throat			IV. Deep esoph.						
		Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	All gear re-moved	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	All gear re-moved	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	All gear re-moved	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	releas-ed en-tangled	disen-tangled	Hook & line <.5 cp. len.	All gear re-moved	
Leatherback	103	7	20	32	0	0	1	0	1	8	0	0	2	32	0	0	0
Loggerhead	46	0	0	12	0	0	10	0	2	14	0	4	0	4	0	0	0
All species	149	7	20	44	0	0	11	0	3	22	0	4	2	36	0	0	0
Mortality ratio:																	
Hardshells		0.20	0.10	0.05	0.30	0.20	0.10	0.45	0.35	0.25	0.60	0.50	0.50	0.01	0.70	0.60	1.00
Leatherbacks		0.30	0.15	0.10	0.40	0.30	0.15	0.55	0.45	0.35	0.70	0.60	0.60	0.02	0.80	0.70	1.00
Overall Ratio:		Calculated mortality for each cell in the matrix (no. turtles times mortality ratio)															
Leatherback	0.131	2.1	3	3.2	0	0	0.15	0	0.45	2.8	0	0	1.2	0.64	0	0	0
Hardshell**	0.170	0	0	0.6	0	0	1	0	0.7	3.5	0	2	0	0.04	0	0	0
All species	0.143	2.1	3	3.8	0	0	1.15	0	1.15	6.3	0	2	1.2	0.68	0	0	0

*Estimates of the ratio of entangled only to total takes were obtained from a subsample of sets where all turtles were caught on 18/0 and 20/0 circle hooks. This ratio was used to estimate entangled only takes from the hooked takes on 18/0 and 20/0 circle hooks from 2002-2003. The ratio of released entangled to total entangled was 0.05 for all baits, and hooks in 2002-2003. This ratio was used to estimate the number of released entangled leatherbacks for 18/0 and 20/0 circle hooks. No loggerheads were ever released entangled. All other numbers of turtles by categories are totals from the NED observer data as summarized by Epperly.

**All hardshell turtles assumed to have a mortality ratio like loggerheads, since there were too few NED data on other spp to make direct estimates for olive ridley or green turtles

Table 4.5.3.2. Mortality ratio data for turtles caught on swordfish-style gear (J-hooks) in the non-NED during 2002-2003 (based on SEFSC summaries of observer data)

Species	Total	Released Alive															Dead
		Hooked with or without entanglement											V. Entangled only*		VI. Comatose and resuscitated		
		I. Externally			II. Lower jaw			III. Upper mouth/throat			IV. Deep esoph.						
		Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	All gear re-moved	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	All gear re-moved	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	All gear re-moved	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	releas-ed en-tangled	disen-tangled	Hook & line <.5 cp. len.	All gear re-moved	
Leatherback	116	46	34	7	0	0	0	2	0	0	11	2	9	3	0	0	2
Loggerhead	95	1	1	2	0	0	0	6	19	21	9	36	0	0	0	0	0
All species	211	47	35	9	0	0	0	8	19	21	20	38	9	3	0	0	2
Mortality ratio:																	
Hardshells		0.20	0.10	0.05	0.30	0.20	0.10	0.45	0.35	0.25	0.60	0.50	0.50	0.01	0.70	0.60	1.00
Leatherbacks		0.30	0.15	0.10	0.40	0.30	0.15	0.55	0.45	0.35	0.70	0.60	0.60	0.02	0.80	0.70	1.00
Overall Ratio:		Calculated mortality for each cell in the matrix (no. turtles times mortality ratio)															
Leatherback	0.319	13.8	5.1	0.7	0	0	0	1.1	0	0	7.7	1.2	5.4	0.06	0	0	2
Hardshell*	0.404	0.2	0.1	0.1	0	0	0	2.7	6.65	5.25	5.4	18	0	0	0	0	0
All species	0.358	14	5.2	0.8	0	0	0	3.8	6.65	5.25	13.1	19.2	5.4	0.06	0	0	2

*All hardshell turtles assumed to have a mortality ratio like loggerheads, since there were too few NED data on other spp to make direct estimates for olive ridley or green turtles

Table 4.5.3.3. Mortality ratio estimates for turtles caught on swordfish-style gear using 18/0 and 20/0 circle hooks based on NED circle hook bycatch data and non-NED gear-removal ratios.

Species	Total	Released Alive															Dead
		Hooked with or without entanglement											V. Entangled only*		VI. Comatose and resuscitated		
		I. Externally			II. Lower jaw			III. Upper mouth/throat			IV. Deep esoph.						
		Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	All gear re-moved	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	All gear re-moved	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	All gear re-moved	Hook & line >.5 cp. len.	Hook & line <.5 cp. len.	releas-ed en-tangled	disen-tangled	Hook & line <.5 cp. len.	All gear re-moved	
Leatherback	103	31	23	5	1	0	0	9	0	0	0	0	25	9	0	0	0
Loggerhead	46	3	3	6	1	4	5	2	7	7	1	3	0	4	0	0	0
All species	149	34	26	11	2	4	5	11	7	7	1	3	25	13	0	0	0
Gear removal ratios:																	
Leatherback		0.529	0.391	0.08	***	***	***	1.0	0	0	0.841	0.154	0.75	0.25			
Loggerhead		0.25	0.25	0.5	***	***	***	0.13	0.413	0.457	0.2	0.8	0	1.0			
Mortality ratio:																	
Hardshells		0.20	0.10	0.05	0.30	0.20	0.10	0.45	0.35	0.25	0.60	0.50	0.50	0.01	0.70	0.60	1.00
Leatherbacks		0.30	0.15	0.10	0.40	0.30	0.15	0.55	0.45	0.35	0.70	0.60	0.60	0.02	0.80	0.70	1.00
Overall Ratio:		Calculated mortality for each cell in the matrix (no. turtles times mortality ratio)															
Leatherback	0.328	9.3	3.45	0.5	0.4	0	0	4.95	0	0	0	0	15	0.18	0	0	0
Hardshell**	0.218	0.6	0.3	0.3	0.3	0.8	0.5	0.9	2.45	1.75	0.6	1.5	0	0.04	0	0	0
All species	0.294	9.9	3.75	0.8	0.7	0.8	0.5	5.85	2.45	1.75	0.6	1.5	15	0.22	0	0	0

*Estimates of the ratio of entangled only to total takes were obtained from a subsample of sets where all turtles were caught on 18/0 and 20/0 circle hooks. This ratio was used to estimate entangled only takes from the hooked takes on 18/0 and 20/0 circle hooks from 2002-2003. The ratio of released entangled to total entangled was 0.05 for all baits, and hooks in 2002-2003. This ratio was used to estimate the number of released entangled leatherbacks for 18/0 and 20/0 circle hooks. No loggerheads were ever released entangled. All other numbers of turtles by categories are totals from the NED observer data as summarized by Epperly.

**All hardshell turtles assumed to have a mortality ratio like loggerheads, since there were too few NED data on other spp to make direct estimates for olive ridley or green turtles

***No incidences of lower jaw hooking occurred in the non-NED fishery so a ratio could not be established. A conservative approach was used instead where the ratios from category III were used, with the rationale that gear removal a category II interaction would be the same difficulty or even easier than category III.

5.0 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 and their habitats. Stranding data indicate sea turtles in Atlantic waters die of various natural causes, including cold stunning, 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 sea turtles recovered by the stranding network is unknown.

Most of the fisheries described as occurring within the action area (*Status of the Species and Environmental Baseline*), are expected to continue as described into the foreseeable future. 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. Numerous fisheries in State waters along the Atlantic coast have been known to adversely affect threatened and endangered sea turtles. The past and present impacts of these fisheries have been discussed in the *Environmental Baseline* section of this Opinion. NOAA Fisheries is not aware of any proposed or anticipated changes in most of these fisheries that would substantially change the impacts each fishery has on the sea turtles covered by this Opinion.

In addition to fisheries, NOAA Fisheries is not aware of any proposed or anticipated changes in other human-related actions (e.g. poaching, habitat degradation) or natural conditions (e.g. over-abundance of land or sea predators, changes in oceanic conditions, etc.) that would substantially change the impacts that each threat has on the sea turtles covered by this Opinion. Therefore, NOAA Fisheries expects that the levels of take of sea turtles described for each of the fisheries and non-fisheries will continue at similar levels into the foreseeable future.

6.0 JEOPARDY ANALYSIS: Effect of Action on Likelihood of Survival and Recovery

The analyses conducted in the previous sections of this opinion serve to provide a basis to determine whether the proposed action would be likely to jeopardize the continued existence of ESA listed sea turtles known to interact with the fishery. In Section 4, we have outlined how the interactions with the pelagic longline fishery can affect sea turtles, and the extent of those effects in terms of annual estimates of numbers of turtles captured and killed. Now we turn to an assessment of the species' response to this impact, in terms of overall population effects from the estimated take, and whether those impacts would appreciably reduce the species' likelihood of surviving and recovering in the wild, thereby jeopardizing the continued existence of the species.

6.1 Loggerhead Sea Turtles

As discussed in the status of the species section, five northwestern Atlantic loggerhead subpopulations have been identified (NMFS SEFSC 2001), with the South Florida nesting and the northern nesting subpopulations being the most abundant. The TEWG (2000) was able to assess the status of those two better-studied populations and concluded that the South Florida subpopulation is increasing, while no trend is evident for the northern subpopulation, which is thought to be stable. However, more recent analysis, including nesting data through 2003, indicate that there is no discernable trend over the past 15 years in the South Florida nesting subpopulation (Witherington pers. comm.). For the three smaller nesting aggregations (Yucatán, Florida Panhandle, and Dry Tortugas), there are not sufficient or consistent data to determine trends, as explained in section 3 of this opinion.

Data on the bycatch proportion of loggerheads by subpopulation are not available for the entire U.S. Atlantic pelagic longline fishery. Previous biological opinions have used estimates based upon turtle capture on foraging grounds. The application of coastal foraging grounds data suggested, in the NED, 71-72% of turtles would be from the South Florida nesting aggregation, 17-19% would be from the northern nesting aggregation, and 10-11% would be from the Yucatán nesting aggregation. However, recent genetic analysis of bycaught loggerheads from the NED experiment suggests that individuals from the northern Atlantic loggerhead stock and the larger South Florida Atlantic loggerhead stock are captured roughly in proportion to their population sizes (LaCasella et al. in press). Further data collection and larger sample sizes from all of the rookeries are needed before more reliable mixed stock analysis estimates can be achieved. Although the coastal foraging ground data encompass a wider area, the results of the genetic analysis from the NED-caught turtles are expected to be more applicable, as the turtles were caught in the pelagic environment as opposed to coastal habitats, which can be expected to be utilized differently from the pelagic environment. Additionally, other research has shown that juveniles appear to return to benthic foraging grounds near their natal beaches after they leave the pelagic stage (Bowen et al. in review). Therefore, between the findings of LaCasella et al. (in press) and the fact the longline fishery is widespread throughout the pelagic waters of the Atlantic and Gulf of Mexico, it is assumed that the overall interaction of loggerhead sea turtles with the pelagic longline fishery is in proportion with the overall stock sizes of each nesting aggregation. That is, the longline fishery is not believed to be affecting any stock disproportionately, which would be a factor to consider when examining the threat of any individual stock being extirpated.

The individuals taken in the pelagic longline fisheries are pelagic juveniles or juveniles making the transition between pelagic and benthic modes, but not breeding age adults or even large sub-adults. All life stages are important to the survival and recovery of the species; however, it is important to note that individuals of one life stage are not equivalent to those of other life stages. Loggerhead sea turtles have very long developmental times before reaching maturity (up to 38 years). Individuals in earlier life stages are subject to many potential sources of mortality, both natural and human-induced, prior to reaching sexual maturity. The number of individuals in the pelagic juvenile stage is therefore probably much, much larger than the older stages, because only a small proportion of individuals survive through the long pelagic juvenile stage to reach sexual maturity. Only a fraction of pelagic juveniles are ever expected to contribute to the population through reproduction, and thus are not as valuable to the population as a breeding age adult. The loss of a certain number of pelagic juveniles, therefore, is less of a threat to the species' survival and recovery compared to an equal loss of sexually-mature adults. On the other hand, because the pelagic juvenile stage has large numbers, the species' overall population rate of growth (or decline) can be quite sensitive to changes in survival and mortality rates of the pelagic juvenile stage. In the absence of information on absolute sizes of the various age classes, however, we cannot directly convert the anticipated annual mortality of loggerheads from the proposed action, expressed in number of individuals, into a change in the mortality rate acting on the pelagic juvenile stage.

In 2001, NOAA Fisheries' (SEFSC) issued a stock assessment of loggerhead and leatherback sea turtles that had 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 for loggerheads (there was insufficient data for leatherback modeling), 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. This document built upon the modeling and analysis presented in the Heppell et al. (2003) chapter in Bolten and Witherington (2003), which was in press at the time NMFS SEFSC 2001 was published. The chapter contained a review of loggerhead population modeling and updated the modeling technique with new information compared to those previously used by Frazer, Crouse, Crowder, and Heppell. Additionally, the SEFSC 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, represent the best available scientific and commercial information for the Atlantic and provide further analysis for the jeopardy determinations in this opinion.

The loggerhead population model developed in NMFS SEFSC (2001) was intended to evaluate, among other things, the effects on overall population growth rates when the survival rate of the pelagic juvenile stage was varied. This allowed them to model changes in impacts from basin-wide longline fisheries. The model was run with three different population growth rates (population lambda), pre-1990 (before TED use might be expected to confound mortality estimates from strandings). Those lambdas are 0.95 (from Cape Island, S.C. – the most important nesting beach for the northern subpopulation – nesting trends [TEWG 2000]), 0.97 (from Cumberland Island, Georgia – one of the longest continuously monitored nesting sites for the northern subpopulation – nesting trends [Frazer 1983]), and 1.0 (from the nesting trends meta-analysis of multiple separate northern subpopulation nesting beaches [NMFS SEFSC 2001 Appendix 1]). NMFS SEFSC (2001) cautions with respect to the meta-analysis, however, 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." Additionally, the lambda=0.95 scenario (a 5% annual decline in population), while the most conservative, is not supported by other data sets in the region, and much of the Cape Island decline occurred long ago and may not be indicative of more recent population performance.

The modeling included analyses of three different sex ratios as well, with female offspring accounting for 35%, 50%, and 80% of the hatchlings. Based upon observed sex ratios and genetic data of foraging ground populations, the sex ratio for the northern nesting subpopulation was thought to be skewed towards males, with only 35% of hatchlings being female. The sex ratios for the South Florida nesting subpopulation was thought to be skewed as high as 80% female. An ongoing study by Wyneken et al. (2004), however, indicates that the sex ratio issue may not be as clear as previously thought, but the initial results are preliminary and based on only one year of sampling, which may not be reflective of long-term conditions. Further research is necessary to better understand the dynamics of the sex ratios produced by each nesting subpopulation.

The model looked at population level effects of pelagic longline mortality by examining changes in annual pelagic juvenile survival of +10%, +5%, -5%-, and -10%. The base-case, or status quo, pelagic juvenile survival rate was solved for assuming a stable age distribution and survival rates of benthic juvenile and adult stages derived from pre-1990 strandings information. Because loggerhead turtles are so long-lived, the adult and large benthic juveniles that contributed to the pre-1990 data set may not have been exposed to pelagic longline fishing when they were pelagic juveniles, or the fishing effort when they were in that stage had not yet increased to present levels. It may be, then, that the base-case pelagic juvenile survival in the SEFSC (2001) model is optimistic, compared to present conditions. The SEFSC report did not attempt to assign a most likely scenario and certainly did not say that pelagic longline fishing had altered pelagic juvenile survival by any specified amount. The model is still useful for assessing how large of a change in survival (increase or decrease) is necessary to produce corresponding population growth or decline.

The June 14, 2001, opinion concluded that the longline fishery, as then prosecuted, was likely to jeopardize loggerhead sea turtles. The RPA of that opinion used the NMFS SEFSC (2001) models to determine how large a reduction in pelagic mortality was necessary to move the modeled population from declining to stable or from stable to increasing. Such a population response would be evidence that the appreciable reduction in likelihood of survival and recovery had been removed. The RPA determined that a 55% reduction in longline mortality on loggerheads in the Atlantic was necessary. The RPA also provided measures to achieve that rate of mortality reduction in the U.S. longline fleet. Calculation of the 55% bycatch mortality reduction target was based on achieving a positive change in overall pelagic juvenile survival of 10%.

The proposed action continues to achieve the 55% bycatch mortality reduction for loggerheads from the U.S. fishery, compared to the status quo considered at the time of the 2001 opinion. Anticipated annual total takes of loggerheads are about a third less (635 vs. 991), and post-hooking mortality associated with the use of circle hooks instead of J-hooks will be about half as much (21.8% vs. 40.4% mortality). Therefore, the total loggerhead mortality is expected to be reduced from over 400 to 143 per year.

In addition, the new TED regulation (published on February 21, 2003 [68 FR 8456]) represents a significant improvement in the baseline affecting loggerhead sea turtles. Shrimp trawling is considered to be the largest source of anthropogenic mortality on loggerheads. Because the rule went into effect only recently, its beneficial effects have not been realized yet. The SEFSC (2001) model, however, can be used to look at the expected population effect of the new TED regulations. The model has built in that the effect of introducing fully effective TEDs is a 30% reduction in total mortality on any life stages small enough to escape through the openings. Based on the findings of Epperly and Teas (2002), the NMFS SEFSC model assumes that small benthic juvenile loggerheads (<70 cm) have benefitted from TED requirements since 1990, but that large juveniles and adults had previously experienced no reduction in total mortality compared to pre-TED days. It is now expected that the full 30% mortality reduction benefit is being extended to large juvenile and breeding adult loggerheads. Note, this is not a 30% reduction in shrimp-related mortality, but a reduction from the total level of mortality from all sources. Epperly et al. (2002) estimated a 94% decrease in shrimp-related mortality for loggerheads in the southeast U.S. as a result of the new TED rule.

Even assuming that pelagic juvenile survival has already been reduced below the model's base-case by as much as 10%, the results of the models show that under any sex ratio and an initial lambda of 0.97 or 1.0 (as explained above, 0.95, even for the northern nesting subpopulation, is considered to be overly pessimistic and not supported by the most recent data), loggerhead populations are expected to increase (rather than merely stabilize) with a 10% increase in pelagic juvenile survivorship. The proposed action is expected to reduce mortality resulting from the U.S. portion of the pelagic longline fishery by an amount commensurate with what is required of the international longline fleets to effect a 10% increase in pelagic juvenile survival. Applying the same standard used in the June 14, 2001, opinion, this reduced impact from the U.S. longline fishery would be at a level where it would not be expected to contribute to the appreciable reduction of the likelihood of survival and recovery for loggerhead sea turtles. It is important to note that although this modeling of the effect of the longline mortality reductions and TED rule expansion benefits applies most directly to the northern and South Florida subpopulations, the same benefits are expected for the other, smaller subpopulations for which there is not enough nesting data to model. Because the take from the longline fishery is expected to be proportional to the subpopulations' sizes, no disparate impact is expected for any of the smaller subpopulations. Additionally, although there is insufficient data to determine nesting trends, none of the smaller subpopulations show indications that they are currently in decline. Therefore, the fact that the modeling predicts positive trends for the larger subpopulations under the various scenarios indicates that the same should be expected for the smaller subpopulations.

In this opinion's analysis, we will also look at the actual estimated take and mortality levels of loggerheads associated with the proposed action, in light of the species' status and cumulative effects, and not just examine relative mortality changes in the models. Loggerhead sea turtles are highly migratory and have the potential to interact with pelagic longline fisheries throughout the Atlantic basin. An analysis of the international pelagic longline fisheries' impacts on loggerhead sea turtles throughout the Atlantic and Mediterranean estimated that the annual take ranged from 210,000-280,000 incidences (Lewison et al. 2004). Using a 40.4% post-interaction mortality (assuming use of J-hooks and minimal dehooking and gear removal), and the mid-point of the take range (245,000), it is estimated that 98,989 mortalities occur annually in the international pelagic longline fishery in the Atlantic and Mediterranean. Of course, there is a great deal of uncertainty and variability around these basin-wide estimates. Based on the proposed action, the U.S. Atlantic pelagic longline fleet is expected to take 599 loggerhead sea turtles (182 mortalities) in 2004, and 635 (143 mortalities) annually in subsequent years. This represents only 0.6% of the takes and 0.1% of the estimated mortality (0.2% in 2004) from all of the Atlantic pelagic longline fisheries.

Loggerheads affected by pelagic longline fisheries still have many years, perhaps decades, before reaching maturity. During this time they experience mortality from numerous natural and human sources, so we expect that the effect of longline fisheries on loggerhead populations will be difficult to detect in the only long-running, reliable index of loggerhead abundance – nesting data. The international pelagic longline fleet has a large estimated annual take for the entire Atlantic basin. The proposed action would reduce the U.S. contribution to basin-wide longline mortality to only one-tenth of a percent: if the U.S. fishery did not exist, the difference in overall take would likely not even be noticeable. Although any level of take and mortality theoretically has a negative effect on the overlying population, we believe that the take and mortality of loggerheads associated with the proposed action is not likely to be a detectable adverse effect given that:

- Interactions are with the pelagic juvenile stage, which is likely the most numerous age class;
- Basin-wide interaction levels and mortality are very large;
- The U.S. longline fleet represents only 0.1% of the annual loggerhead mortality; and
- Although we have concerns about the status of some loggerhead populations in the western Atlantic due to their failure to recover, the data do not indicate that any of the nesting subpopulations are currently declining, despite having experienced capture and mortality in pelagic longline gear for years.

Therefore, as a result of the above analysis and the various factors considered, we believe that the takes and resulting mortality of loggerhead turtles associated with the proposed action are not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of either the survival and recovery of loggerhead sea turtles in the wild.

6.2 Other Hardshell Sea Turtle Species

Other hardshell sea turtle species are known to interact with the longline fishery, but only in rare instances. We anticipate that up to 35 individuals from the combined species, Kemp's ridley, olive ridley, green, and hawksbill, may be estimated taken in any year. This level of take would be predicted to correspond to up to 8 lethal takes per year (through post-release mortality). Because of the high variability in the observed capture of these species, some years may have no observed and thus no estimated captures. It is unlikely that any single species of these four will be consistently impacted year after year. Because of the rarity and intermittence of the interactions, we believe that the effects of the proposed action are not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival and recovery of green, hawksbill, Kemp's ridley, or olive ridley sea turtles in the wild.

6.3 Leatherback Sea Turtles

The best available stock assessment for evaluating Atlantic leatherback populations is NMFS SEFSC (2001). That assessment is somewhat confounded by the near absence of data or high uncertainty for estimates of juvenile and adult survival and mortality, age and growth; and also, by the intermittence of nesting data from the major leatherback nesting beaches on the north coast of South America. Nevertheless, a very strong signal of declining nesting was detected for the nesting aggregation of Suriname and French Guiana, the largest remaining leatherback nesting aggregation in the world. Nesting there had been declining at about 15% per year since 1987 through the 1990s. From the period 1979-1986, however, the number of nests had been increasing at about 15% annually. As explained in Section 3, there is a great degree of uncertainty and inconsistency regarding the leatherback sea turtle population status and trends. The uncertain trends in nesting at U.S. beaches versus South American beaches complicates our evaluation. Additionally, because of a lack of sufficient data, the population modeling scenarios performed for loggerhead sea turtles are not possible at this point for leatherback sea turtles. Therefore, we are using Spotila et al. (1996) as the latest, most complete estimation of leatherback populations throughout the Atlantic basin (from all nesting beaches in the Americas, the Caribbean, and West Africa) (approximately 27,600 nesting females with an estimated range of 20,082-35,133).

In contrast to the situation with loggerheads, which are mostly impacted by longline fishing early in their development, the leatherbacks captured in the longline fishery are adults and large juveniles. An exact assessment of the leatherback life stages affected by longlining is hampered by the animals' size; it is almost always impossible to bring a captured leatherback safely aboard for any detailed measurements. Therefore, the POP records leatherback size information based on the observer's best estimate of the turtle's carapace length, to the nearest foot, so the information is not very precise. The POP data show that 56% of the leatherbacks are 5' or greater in carapace length. Average straight carapace lengths of nesting females in St. Croix is about 5' (~150 cm) (Eckert et al. 1984). Therefore, it appears that at least half of the bycaught leatherbacks are mature breeders, and the rest are sub-adult animals.

The death of mature breeding females can have an immediate effect on the reproduction of the species. Sub-lethal effects on adult females may also reduce reproduction by hindering foraging success, as sufficient energy reserves are probably necessary for producing multiple clutches of eggs in a breeding year. Additionally, because leatherback sea turtles reach sexual maturity in only 5-15 years, the importance of sub-adults taken in the pelagic longline fisheries is relatively much higher than for loggerhead sea turtles. According to Spotila et al. (1996), survivorship in the juvenile/sub-adult stage of leatherback sea turtles is vitally important to the future of the species; population models are most sensitive to variation in juvenile/sub-adult survival. The number of individuals in the various stages would also not be as disparate in leatherbacks as in loggerheads. Because of the duration of the stages and the required, associated survivals (see Spotila et al. 1996), the total number of subabult leatherbacks is probably similar to the total number of adults in the population, and is certainly within the same order of magnitude. The roughly equal distribution of subadults and adults in the POP database support this conclusion. Once juvenile leatherbacks become susceptible to capture in longline gear (whether by size, behavior, or distribution), we believe susceptibility likely remains relatively constant.

We do not have good information on the sex ratios of the leatherbacks caught in the longline fishery, or even leatherbacks generally. We assume the population sex ratio is 50%. In their published leatherback population model, Spotila et al. (1996) also assume a 50% sex ratio.

As with loggerhead sea turtles, leatherbacks are highly migratory and have the potential to interact with the pelagic longline fishery wherever it is prosecuted in the Atlantic. Throughout the Atlantic basin, including the Mediterranean Sea, a total of 30,250-70,000 leatherback sea turtles are estimated to be captured every year by pelagic longline fisheries (Lewison et al. 2004). Using a middle value from the take range (50,000), a 32.8% post interaction mortality, a 50% sex ratio, and a 50% adult to juvenile ratio, total annual international longline mortality of adult females is estimated to be 4,100 per year. According to these calculations, this accounts for approximately 15% of the total 27,600 nesting female population estimated by Spotila et al. (1996) (20,082 - 35,133).

Under the proposed action, the U.S. pelagic longline fleet is expected to take 805 individuals (266 mortalities) in 2004, and 588 per year (198 mortalities per year) in subsequent years. Using the same calculations as above for the rest of the fishery, the estimated mortality of breeding-age females is expected to be 67 in 2004, and 50 per year thereafter. The U.S. fleet would therefore account for 1.2% of the total longline fishery mortality annually (1.6% in 2004). This is equivalent to 0.18% (0.14 - 0.24%) of the total nesting female population annually (0.24% [0.19 - 0.33 %] in 2004). Another estimated 50 subadult females per year (67 in 2004) are expected to be killed by the U.S. fleet as a result of the proposed action. If numbers of adult females and subadult females are similar, as we believe, the proportional impact to the subadult stage from the proposed action would also be similar.

The overall numbers of leatherback takes reported in Lewison et al. (2004) are very high, and the U.S. contribution appears small relative to the overall pelagic longline fishery in the Atlantic and Mediterranean. The mortality of adult and subadult leatherbacks – 50 females from each stage, every year – is not discountable, however. If the mortality were one-time or short-term, there seems little doubt that a species with a life history like leatherbacks would easily replace the losses and that level of mortality would not have a noticeable effect on the population. Continued year after year, as the pelagic longline fishery is expected to continue, however, the loss of 50 adult females and 50 subadult females, from a population whose adult females number only in the low tens of thousands, is expected to have appreciable population effects. The loss of the adult females will directly affect our only population metric – nesting – and will also eliminate those nesters' immediate contribution to the species reproduction. The fact that similar numbers of subadult females are also being removed directly reduces the likelihood that the population will replace the lost adults quickly, as those sub-adults are the exact animals that would recruit to the breeding population soonest. Continued depressed reproduction from the reduced replacement of the lost adult females will, in turn, further depress the numbers of hatchlings and juveniles going into the population that could eventually replace the lost sub-adults. At some point, compensatory effects (e.g., increased hatching success on the nesting beach as the density of nests declines) may slow or even stop such a decline, but the population would already be reduced and thus more vulnerable to extirpation. On the other hand, depensatory effects may also occur with ever smaller populations (e.g., increased risk of predation to solitary individuals or nests or inability to find a mate) and further accelerate the decline.

Despite some apparent similarities between the situations with loggerhead and leatherback mortality in the longline fishery in the Atlantic, there are some notable differences. First, the leatherback populations are probably smaller than loggerheads. Second, the mortality from the longline fishery is acting directly on leatherback breeders and soon-to-be breeders, rather than small juveniles. Third, while the impacts from the U.S. longline fleet are small compared to the international fleet for both species, the U.S. fleet's relative contribution to leatherback mortality is an order of magnitude higher than for loggerheads. At over 1% of the total annual longline mortality, and annually killing about 0.2% of the estimated number of adult and subadult females in the population, we believe that the long-term continuation of the proposed action can be expected to appreciably affect leatherback populations in the Atlantic. Fourth, while we stated that our concern for loggerheads was lessened by the absence of evidence that the western Atlantic subpopulations are currently declining, that was based on loggerhead nesting data that is exponentially more accurate, precise, and longer-term than what is available for leatherbacks. Our concern for leatherbacks is heightened by the fact that any assessment of the status and trends of the largest remaining leatherback nesting assemblage in the world is so confused and confounded. The U.S. longline fishery primarily affects leatherbacks from this assemblage, and the absence of evidence on the effects on that population is not a reasonable assurance that those effects are not occurring. Fifth, while we have well-parameterized population models for loggerhead turtles that allow us to assess the effects of changes in pelagic and coastal fishery mortality on population growth rates, we have little or no knowledge of the life history parameters for leatherbacks. We therefore do not have robust population models with relatively optimistic outlooks, as we do for loggerheads. Sixth, the beneficial effects of the proposed action for leatherbacks are much less certain than for loggerheads. The effects of the 16/0 circle hook on leatherback catch rates have not been measured, but we are assuming they will be the same as observed with the 18/0 circle hook. With loggerheads on the other hand, the effect of 16/0 circle hooks on hooking location – and thus post-hooking mortality – has been studied.

We believe that the effects of the proposed action on leatherbacks, considering the species status and cumulative effects, can be reasonably expected to appreciably reduce the likelihood of the survival and recovery of leatherbacks in the Atlantic, by reducing their numbers and reproduction. Taking into consideration the global status of leatherback sea turtles and that the Pacific population is known to be much smaller than the Atlantic population and is in drastic decline, an action that appreciably reduces the likelihood of leatherbacks' survival and recovery in the Atlantic most certainly reduces the likelihood of the species' survival and recovery globally.

6.4 Summary

Based upon our review of the best available information, including the effects of the proposed action, the status of the species, and cumulative effects, we believe that the proposed action *is not* likely to reduce appreciably the likelihood of the survival and recovery of loggerhead, green, hawksbill, Kemp's ridley, or olive ridley sea turtles in the wild by reducing their reproduction, numbers, or distribution. Based on the same review, we believe that the proposed action *is* likely to reduce appreciably the likelihood of the survival and recovery of leatherback sea turtles in the wild by reducing their reproduction and numbers.

7.0 CONCLUSION

We have analyzed the best available scientific and commercial data, the current status of the species, environmental baseline, effects of the proposed action, and cumulative effects to determine whether the proposed action is likely to jeopardize the continued existence of any sea turtle species. In doing so, the analysis focused on the impacts and population response of sea turtles in the Atlantic Ocean. However, as discussed in section 4.1.1 Scope of the Analysis, the impact of the effects of the proposed action on the Atlantic populations is directly linked to the global populations of the species, and the final jeopardy analysis is for the global populations as listed in the ESA.

Based upon the analyses described above, it is our opinion that long-term continued operation of the Atlantic pelagic longline fishery, authorized under the Atlantic Highly Migratory Species FMP:

- **is not likely to jeopardize the continued existence of loggerhead, green, hawksbill, Kemp's ridley, or olive ridley sea turtles**; and

- **is likely to jeopardize the continued existence of leatherback sea turtles**.

Critical habitat has not been designated for these species in the action area; therefore, the destruction or adverse modification of critical habitat will not occur.

8.0 Reasonable and Prudent Alternative

This opinion has concluded that the HMS pelagic longline fishery, as proposed, is likely to jeopardize the continued existence of 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 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) we believe would avoid the likelihood of jeopardizing the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

Throughout this opinion, we have recognized that threatened and endangered sea turtles face a risk of global extinction because of a wide array of human activities and natural phenomena. We recognize, for example, that the number of turtles killed by foreign longline fleets poses 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 existence of these other threats, however, does not affect NOAA Fisheries' responsibility to ensure that the proposed action is not likely to jeopardize the continued existence of leatherback turtles. An RPA that ensures that the HMS pelagic longline fishery is not likely to jeopardize the continued existence of listed species may not necessarily ensure that the species will recover in the wild and may not prevent other human activities from causing their ultimate extinction.

8.1 Specific Elements of the Reasonable and Prudent Alternative

NOAA Fisheries must undertake management and conservation measures to address and reduce the adverse effects to leatherback populations expected to result from the proposed action. Specifically, NOAA Fisheries must (1) reduce post-release mortality of leatherbacks, (2) improve monitoring of the effects of the fishery, (3) confirm the effectiveness of the hook and bait combinations that are required as part of the proposed action, and (4) take management action to avoid long-term elevations in leatherback takes or mortality. These measures are necessary to avoid the likelihood of jeopardy and to authorize the continued prosecution of the HMS pelagic longline fishery. The RPA is designed to reduce the effects of the HMS pelagic longline fishery 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, with four elements, that must be implemented in its entirety to avoid jeopardizing leatherback sea turtles.

8.1.1 Maximize Gear Removal to Maximize Post-release Survival

Sea turtle post-release survival is not only dependent on the type of interaction (i.e., where hooked, entangled or not), but also on the amount of gear left following the release. Removal of some or all of the gear – except deeply-ingested hooks – is likely to improve the probability of a sea turtle surviving an interaction event. The January 2004 draft post-release mortality criteria account for the probable improvement in survivorship resulting from removal of gear, where appropriate, for each injury. Maximizing gear removal therefore is critical for lowering mortality ratios (see section 4.3).

In this opinion, our jeopardy conclusion for leatherbacks was based on an estimated 805 takes and 266 mortalities in 2004, and an estimated 588 takes and 198 mortalities in subsequent years, continuing indefinitely. The post-release mortality ratio used in estimating the anticipated lethal takes was 32.8%. This post-release mortality ratio was based on the observed fishery's (non-NED experiment) gear removal proportions and the NED experiment's hooking locations with circle hooks. That post-release mortality ratio, therefore, represents the level of post-release mortality we expect if the fishery is being required to use circle hooks, and gear removal rates remain the same.

Based on results from the NED experiment, substantial reductions in mortality can be achieved by maximizing the amount of gear removed from hooked sea turtles. The post-release mortality ratio for leatherbacks using the NED gear removal proportions and circle hook data was only 13.1%. The NED experiments had 100% observer coverage and captains and crew that were well trained, well equipped, and experienced in gear removal from sea turtles. That post-release mortality ratio, therefore, represents the level of mortality we expect if the fishery is required to use circle hooks and to have all required gear-removal equipment on board, and has the training, experience, and willingness to use the equipment.

It is critical that the same level of gear removal achieved in the NED be attained throughout the fishery. Improving the post-release mortality ratio in the entire HMS pelagic longline fishery to levels associated with circle hook use in the NED experiment would decrease total leatherback mortality caused by the fishery by 58%. The NED experience shows that extensive training, experience, and high motivation are needed to achieve these high rates of success. Therefore, NOAA Fisheries must provide outreach and training to maximize gear removal and must monitor the effectiveness of its efforts though the POP.

8.1.1.1 Outreach

NOAA Fisheries must establish a comprehensive outreach program to ensure that fishermen are aware of the safe handling and gear removal requirements of the proposed action, understand how to use the required gear, and understand the importance of maximizing gear removal to maximizing post-release survival of sea turtles. NOAA Fisheries must carry out the following specific tasks:

Training materials
HMS Division must develop and distribute training materials on safe handling of sea turtles and gear removal techniques to all HMS pelagic longline permitted vessels by September 30, 2004. We believe that video (VHS or DVD) is the most effective training format and the most likely format to be reviewed by vessel crews. Development and distribution of a training video should be the first priority for training materials. Additional training materials may include booklets, laminated placards, *etc.*, and electronic versions of these materials to further enhance availability. A significant number of participants in the fishery are Vietnamese-Americans or Latino-Americans. Critical outreach materials must be translated into Vietnamese and Spanish and distributed to vessels likely to have Vietnamese-speaking or Spanish-speaking crew. Translation may be time-consuming. Every effort must be made to complete distribution of translated materials by September 30, 2004. Distribution of translated materials must be completed, however, no later than November 30, 2004.

Fishery outreach point of contact
NOAA Fisheries possesses technical expertise on longline gear, sea turtle science, and HMS regulatory requirements in multiple offices. NOAA Fisheries must select a single office, or even an individual, as the point of contact (POC) for permittees and fishermen with questions on requirements for safe handling of turtles and gear removal. Point of contact information must be published in the final rule implementing the sea turtle conservation requirements in the longline fishery and should be included in the training materials, as appropriate.

The POC will have a critical role in ensuring that fishermen learn the requirements, the techniques, and the reasons for maximum gear removal. In addition to simply answering fishermen's questions, the POC must actively reach out to fishermen to learn about their experiences, troubleshoot problems, and share solutions and successful experiences with other fishermen and NOAA Fisheries' scientists and managers.

Training workshops
NOAA Fisheries must conduct training workshops to explain the final sea turtle conservation requirements to fishermen. We recommend that the POC conduct the training workshops to maximize the POC's overall rapport and effectiveness; however, NOAA Fisheries may design and staff the training workshops as deemed appropriate. At least three voluntary training workshops must be given by September 30, 2004: one each in the Gulf of Mexico, the mid-Atlantic, and the New England regions. Additional workshops beyond the minimum three are encouraged, as are workshops after September 2004, to ensure the broadest possible contact with affected fishermen.

Outreach through the POP
Pelagic longline observers are the face of NOAA Fisheries to many longline fishermen. Observers will interact longer and more closely with a greater depth of the fishery participants than any training workshops, and they will do so under actual fishing conditions where the effectiveness of the learning can be much greater. The SEFSC must train and require the POP observers to provide

additional outreach and training to captains and crews on sea turtle safe handling and gear removal techniques.

At the outset of trips, the observer must offer to review the safe handling and gear removal techniques with the captain and crew and to provide instruction in the use of the required onboard equipment. Because the observer's fundamental role is to document how the fishery is conducted and its effects on sea turtles, and because the integrity of the data they collect on sea turtle release condition must be protected if it is to be valid for extrapolations to the overall fishery, observers may not assist the crew in any way during sea turtle handling and release. Observers may still handle turtles that have been brought aboard by the crew to carry out permitted scientific tasks (e.g., attaching standard or telemetry tags, identifying and measuring animals, taking genetic samples, etc.). During the course of a trip, observers should be encouraged to share with the captain and crew the turtle handling and gear removal experiences, both successes and problems, that they have observed. Observers should provide constructive feedback to captain and crew at an appropriate opportunity after a turtle is captured and released. Before disembarking, the observer must inspect any sea turtle safe handling and gear removal equipment onboard and record whether the required gear was available. The SEFSC must include this information in its quarterly reports (see 8.1.2 below) so that the HMS Division and SERO-PRD can assess the implementation of this RPA. The information is not intended to be used for enforcement purposes.

The SEFSC must strive to place an observer on each active, permitted longline vessel at least once over the course of 2004, 2005, and 2006. The Director, SEFSC, may specify the most appropriate way to implement this requirement to preserve the accuracy of take estimates based on observer data. If the Director, SEFSC, determines that this requirement cannot be achieved in any form without seriously compromising the scientific validity of the take estimates, this requirement need not be implemented. In any event, the SEFSC must include in its quarterly reports (see section 8.1.2 below) the number of unique vessels that were observed. Through 2006, the quarterly report must also include the cumulative number of unique vessels observed since the effective date of the final rule implementing the sea turtle conservation requirements and an estimate of the number of active vessels that have not been observed over the same period.

Maintenance of Outreach Function
NOAA Fisheries must maintain a viable outreach function, beyond the time necessary merely to accomplish the initial steps identified in this sub-element of the RPA. While demand for training workshops will likely diminish over time, interaction with fishermen will remain critical for long-term success, and materials may need occasional reproduction or updating based on industry experiences or new scientific information.

8.1.1.2 Fisherman Training Certification

The HMS Division must develop and implement a training and certification program to ensure that the captain of each permitted HMS vessel authorized to fish with pelagic longline gear has successfully completed training on sea turtle safe handling and gear removal by December 31, 2005. Training must include demonstrations of safe turtle release equipment and protocols and pelagic longline equipment modifications required under proposed HMS regulations. Training should also include hands-on instruction, which has proven highly effective in transferring technical information. Training content must be developed in consultation with the SEFSC. The certification process must reasonably ensure that the certified individual has actually completed and understood the training material. The certification process must also include documentation requirements so that law enforcement officers can readily verify a vessel's compliance with the requirement to have a certified captain. Provision must be made for periodic training and certification opportunities, after 2005, so new captains can receive training.

8.1.1.3 Verification of Maximized Gear Removal

We believe that the outreach and certification requirements specified in this RPA element, along with experience the fishermen gain with time, will bring the whole fleet up to the high level of gear removal performance that was seen in the NED experiment. The fleet will receive initial outreach in 2004, mandatory training and certification in 2005, and will gain experience after that training throughout 2006. By the beginning of 2007, then, we believe that the fleet will have reached the maximum performance level seen in the NED experiment.

NOAA Fisheries must monitor the overall expected mortality of sea turtles caught in the longline fishery, based on their release condition and the January 2004 draft post-release mortality criteria discussed in section 4.3 above. The SEFSC must instruct POP observers to continue collecting detailed information on all sea turtle interactions including initial interaction type, hooking location, amount of gear remaining upon release, and the animal's condition upon release. The SEFSC must use this information to determine the net mortality ratio associated with the observed captures, according to the method of Epperly and Boggs (2004). The net mortality ratio calculated for leatherbacks and loggerheads[3] must be included in the quarterly and annual reports (see section 8.1.2 below).

We have established net mortality ratio targets to ensure that the fleet's progress in improved sea turtle handling and gear removal reach the net mortality ratios of 13.1% for leatherbacks and 17.0% for loggerheads by the beginning of 2007 (the long-term targets). These targets are based on even, annual progress in 2004, 2005, and 2006. The targets are presented in Table 8.1.1.3.

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[3] This RPA is designed to remove jeopardy for leatherback turtles. Implementing the measures in this RPA will also benefit loggerhead turtles. Where those benefits affect the anticipated impact on loggerhead turtles in a quantifiable way, we are including those reduced impacts in the RPA.

Table 8.1.1.3 Net Mortality Rate Performance Standards

	Assumed 3rd & 4th Quarters, 2004	Target for 1st Quarter, 2005	Target for 1st Quarter, 2006	Target for 1st Quarter, 2007 and onward
Leatherbacks	32.8%	26.2%	19.6%	13.1%
Loggerheads	21.8%	20.2%	18.6%	17.0%

8.1.2 Improve the Accuracy and Timeliness of Reporting and Analysis

The sea turtle take estimates used in our jeopardy analysis are produced from observed bycatch rates and logbook effort data. Bycatch rates (currently catch per hook) are quantified based on observer data by geographic area and quarter. The estimated bycatch rate is then multiplied by the total fishing effort (currently number of hooks) reported in the mandatory logbook to obtain estimates of the total interactions for sea turtles. Both the accuracy of the data and the timeliness of its reporting are critical to monitoring the effects of the fishery and assessing whether the RPA avoids jeopardy for leatherbacks. Observer coverage must be sufficient to produce a statistically reliable sample of the HMS pelagic longline fishery that accurately represents the entire fishery. These data must also be available in a timely fashion to monitor the fishery and take corrective action to avoid long-term elevation of turtle takes beyond those authorized in this opinion. Levels of observer coverage and timeliness of reporting have been insufficient in the past. Improvement in the level of observer coverage and within-year and annual reporting are needed.

The June 14, 2001, opinion included terms and conditions concerning observer coverage and reporting that were intended to ensure that monitoring would: (1) detect adverse effects resulting from the HMS pelagic longline fishery; (2) assess the actual level of incidental take in comparison with the anticipated incidental take documented in that opinion; and (3) detect when the level of anticipated take is exceeded. As in previous consultations, 5 percent observer coverage in the pelagic longline fishery was required. Observer coverage was required to be distributed according to a stratified random sampling scheme that would adequately sample the fishery to determine levels of protected species takes. At a minimum, the regime had to ensure that sampling occurs annually at a statistically reliable level of coverage within all statistical areas fished. Reporting requirements included quarterly reports of observed takes and annual reports of estimated takes.

Between 1992 and 2000, the overall average coverage was 4 percent (Beerkircher et al. 2002). The only time the 5 percent coverage was actually achieved was between 1993 and 1995, when POP funding was at its highest level. From 1996 to 2000, funding and logistical problems (e.g. not being able to place observers on all selected trips) resulted in an average of only 3.4 percent observer coverage, and the 5 percent target level was never achieved in any single year.

In 2001 through 2003, there was 100 percent coverage for the NED experiment which was technically not part of the fishery authorized in the 2001 opinion. Observer coverage in areas excluding the NED was only 2 percent during 2001 and overall coverage averaged only 3.7 percent for that year. The POP target coverage level was raised to 8 percent in 2002 to meet new ICCAT targets and to improve the precision of catch and bycatch estimates specified in NOAA Fisheries' guidelines for fisheries observer coverage levels (NMFS 2003). Overall observer coverage (including the NED experiment) achieved the new target level in 2002, but was only 3.7 percent excluding the NED experiment. Thus, a representative cross section of the fishing effort in each area and during each quarter of the year was not achieved. Reported effort data in 2003 are not available. Quarterly reports, which estimate the percent coverage obtained based on the previous year's reported effort data, estimate overall coverage was 6.3 percent. It is critical that NOAA Fisheries achieve not only its new target level, but achieve that target level in as many areas and quarters as possible.

Garrison (2003a) identifies several sources of bias and uncertainty in the take estimates from a lack of observer coverage in certain statistical fishing areas and quarters. Fishery observer effort is allocated across 11 large geographic areas and the calendar quarters based on the historical fishing range of the HMS pelagic longline fishery (see Figure 2.3.1 C). Offshore areas in the SAR, TUN, and TUS areas have only rarely been included in the POP observer coverage. Bycatch rates for year-quarter-area strata with greater than 10 reported HMS pelagic longline fishery sets and no corresponding observer coverage were replaced in the take estimation method with the mean bycatch rate observed in the quarter-area stratum across the previous five years. For some strata, there was no observer coverage within the previous five years, thus no bycatch estimates were made, and turtle catches were assumed to be zero, despite reported fishing effort in those strata. Applying observer data from previous years is inherently uncertain since bycatch rates can vary strongly in time and space. The most glaring omission is the generally low current and historical coverage of the offshore areas including the SAR, TUN, and TUS. It is currently unknown, therefore, if there are significant interactions with listed species in these sectors of the longline fishery

Although all of the required quarterly and annual reports have been completed to date, they have not always been done in a timely fashion. The timeliness of reporting and take analysis are dependent on the availability of POP observer data and pelagic longline logbook data. Observer data collected during a fishing trip are entered into a computer usually within seven days upon the observer's return to port. Because observers are sometimes still at sea at the end of a quarter, it takes a minimum of 30 days after the close of each quarter before all the data are available to complete the quarterly report. Quarterly reports, therefore, are typically completed by the middle of the subsequent quarter. Because of the work load caused by the 2001-2003 NED Experiment project, the submission of protected species summary documents by the POP was often greatly delayed. Annual reports have taken significantly longer to prepare than the quarterly reports and have sometimes been prepared only every other year. For example, the estimated sea turtle takes in 2001 were presented in the same report as the estimated sea turtle takes in 2002, which was not completed until December 2003. Annual reports of estimated takes depend on the availability of observer data, and also on reported effort data. Late logbook forms and quality control procedures have resulted in final effort data not being available until six-months into the subsequent year.

Quarterly reports are presently required to include observed take data, the number of sets observed by statistical area, and an estimate of the observed coverage level. Because the SEFSC does not compile effort data until the end of the year, however, they have not developed take estimates for the quarterly reports. Thus, the fishery is ultimately monitored by the annual take estimate reports. The delay in receiving theses takes estimates caused exceedances of the incidental take level established in the June 2001 opinion in 2001 and 2002 to go undetected until November 2003. Had the 2001 take estimates been available in a timely manner, corrective action may have been taken to avoid exceeding take in 2002.

In our jeopardy analysis, we concluded that the long-term, incidental mortality of 198 leatherback turtles annually, based on the estimated annual capture of 588 animals, was expected to reduce the likelihood of leatherback turtles' survival and recovery in the wild. The first element of this RPA will, over the next two-and-a-half years, reduce the net post-release mortality for leatherback turtles by about 60%, and we have specified requirements to monitor this reduction. No measures are specified, however, in this RPA that further reduce the estimated annual bycatch levels of leatherbacks beyond the level predicted for the proposed action. Because the basis of our jeopardy determination – total estimated mortality – is the product of the post-release mortality ratio and the estimated take levels, we must also ensure that take levels do not become elevated.

In the jeopardy analysis, we stressed that one-time or short-term mortality on leatherbacks, on the scale of the proposed action's annual impacts, is not likely to produce any noticeable effect on the population. Similarly, minor, short-term exceedance of estimated take and mortality levels is not expected to have noticeably worse population effects, as long as take and mortality do not also increase on average over the long term. High degrees of variability in natural and anthropogenic mortality, nesting levels, recruitment success, and the inherent ability of long-lived animals to withstand short-term impacts require us to focus on long-term, rather than short-term effects, because of both the biological significance of long-term effects and our likely inability to detect a population response from short-term impacts.

NOAA Fisheries has issued incidental take for the fishery on an annual basis in the past. Annual take estimates have high variability, however, because of natural and anthropogenic variation. For example, leatherback takes over the history of the observer program have ranged from as low as 308 in 1997 to the all time high of 1,208 in 2001. This high variability and the absence of within-year take monitoring of estimates have prevented HMS Division from being able to detect possible take exceedance early and pursue corrective action to prevent exceedance of the annual authorized levels of incidental take.

To ensure that the long-term operation of the fishery does not jeopardize the continued existence of leatherback turtles, NOAA Fisheries must improve its ability to monitor takes in the fishery and must be able to take timely corrective action. However, corrective action within any one single year will likely never be practicable, and minor or short-term exceedance of annual predicted take levels is not believed to be sufficient to jeopardize leatherbacks. Therefore, this RPA and the associated ITS will establish a three-year authorized take level for sea turtles. The SEFSC must provide timely take information during the course of each three-year period to allow the HMS Division ample time to detect significant problems in remaining within the authorized take levels and to take corrective action (e.g., closure of sea turtle interaction hot spots, additional gear restrictions). We believe a three-year period is the shortest practicable time period for the SEFSC and the HMS Division to detect and avoid potential long-term take exceedance. We also believe that three years is sufficiently protective of leatherback turtles: within a reporting period, highly elevated takes could only theoretically continue for two consecutive years before corrective action would be taken in the third year to maintain the total take at the authorized annual average level. Maintaining long-term takes at the average 3-year level considered in this opinion, even though higher take levels may occur in certain years, will ensure that the effects of elevated takes do not reduce appreciably the likelihood of leatherbacks' survival and recovery in the wild.

8.1.2.1 Improve Observer Coverage

The SEFSC must achieve at least 8% observer coverage in the HMS pelagic longline fishery, based on total annual reported sets. For this RPA, the 8% observer coverage level is a minimum level, not a target. NOAA Fisheries must provide the POP funding at a level that will ensure the availability of an observer for any scheduled trip. The SEFSC must adjust the POP's internal target number of observed sets to achieve the 8% minimum coverage level, taking into account the program's average success rate of observing only 81% percent of the planned sets. The SEFSC must strive to improve communication between vessel operators and the POP to increase the POP's success rate in placing observers on longline trips. The SEFSC must increase efforts to achieve observer coverage in areas and quarters where sampling has historically been low: by December 31, 2006, there must be no quarter-area stratum with an assumed sea turtle take of zero because of lack of current or historic observer coverage and current year reported effort over 30 sets.

8.1.2.2 Improve Observer Data Collection

The different types of hooks and baits authorized for use in the pelagic longline fishery may have different effects on rates of sea turtle and target species catch (see 8.1.3 below for in-depth discussion). The POP currently records some information on hooks and bait used on observed trips. To be able to use POP data to analyze the potential effects of the newly required hooks and baits, the SEFSC must improve the detail of hook and bait information collected by the POP. The SEFSC must train and require the POP observers to record not only hook size and brand, but also amount of hook offset and whether different sizes, brands, and/or offset hooks are used on a given set. In the case of sets with multiple hook or bait styles, observers must record the proportion of each hook and bait style used, and if any sea turtles are captured, the exact hook and bait involved. It is also recommended that exact hook and bait details be recorded for catches of the primary target species.

8.1.2.3 Improve Within-Year Monitoring

The SEFSC must improve within-year monitoring to detect high take levels as soon as possible by improving the existing quarterly reports:

a) Sea turtle take estimates must be prepared using observer data and preliminary effort data for that quarter. If preliminary effort data are not available, quarterly take estimates must be prepared based on effort data from previous years.

b) Quarterly reports must be submitted to SERO, HMS Division, the Northeast Regional Office Protected Resources Division, and the Office of Protected Resources no later than 45 days into the subsequent quarter. In addition to the information previously provided in the quarterly reports, they must include the quarterly take estimates specified here, the number of unique vessels observed, the cumulative number of unique vessels observed since the effective date of the sea turtle conservation regulations, and the percent of observed vessels that had the required turtle handling and gear removal results.

c) Observed takes by statistical area and quarter over the history of the POP must be reviewed for any notable trends or patterns that can be used to further interpret the significance of the number of observed takes reported during each quarter. A summary of that review should be completed by March 31, 2005. Any take prediction hypotheses stemming from that review must be tested retrospectively using the 2004 quarterly and annual take estimates. Results should be included in the 2004 final estimated takes report.

8.1.2.4 Improve Timeliness of Reporting Yearly Take Estimates

The SEFSC must improve the timeliness of reporting yearly sea turtle take estimates by:

a) Compiling logbook effort data in computer databases and conducting quality control as logbooks are submitted throughout the year, so that effort data are available for analysis as soon as possible after the end of the year;

b) Completing annual take estimates based on observer and effort data by March 15 of each year;

c) Subsequently revising the annual estimates by May 31, if quality control of the effort data for ICCAT purposes results in changes in the effort data; and

d) Immediately providing these take estimates to SERO, HMS Division, the Northeast Regional Office Protected Resources Division, and the Office of Protected Resources.

8.1.3 Confirm Effectiveness of Hook and Bait Combinations

By far the most comprehensive study of the effects of varying hooks and baits on sea turtle bycatch rates and hooking locations is the NED experiment. The NED experiment conclusively demonstrated that significant reductions in loggerhead and leatherback catch rates can be achieved by the use of 18/0 or larger circle hooks or large mackerel bait, instead of the industry-standard J-hooks and squid bait. The NED experiment also demonstrated that an 18/0 or larger circle hook with a 10 offset, in combination with mackerel bait, could outfish the industry-standard J-hook and squid for the target species of swordfish in cold waters, primarily by catching and retaining larger fish. Thus, in the NED at least, the NED experiment produced a fishing gear solution that was beneficial to fishermen and sea turtle conservation.

Concerns have been raised, however, about the economic impacts of applying the NED experiment's results to other areas or other target species. For example, the 18/0 circle hook-mackerel bait combination's ability to catch larger swordfish may not be realized in other swordfish grounds, if those larger fish are not available. In addition, a large portion of the U.S. longline fleet – and probably the large majority of the international longline fleet globally – targets tunas or a mixture of tunas and swordfish. The effect of the 18/0 or larger circle hook on catch rates of tuna has not been extensively studied. The smaller 16/0 circle hook is the gear of choice for tuna-directed fishing in some other fleets (*e.g.* Canada), and the 16/0 circle hook has been demonstrated to outfish a 7/0 J-hook (the industry standard in the U.S. Gulf of Mexico tuna fishery) by 150% (Falterman and Graves 2002). Thus, the 16/0 circle hook is assumed to be an effective gear choice for tuna-directed fishing. In a limited number of sets in the NED experiment directly comparing the target-species performance of 16/0 vs. 18/0 circle hooks in tuna-directed sets, there was no difference in catch rates of yellowfin or bigeye tuna between the two hook sizes, although the sample size was small. In a more extensive hook and bait comparison in the NED experiment, the 18/0 circle hooks baited with squid nominally, but not significantly, outperformed 9/0 J-hooks in catch of bigeye tuna, but this was during swordfish directed catch, where the tuna was only a desirable bycatch

The work of Bolten in the Azores is similar to the NED experiment's approach and is also excellent, with controlled hook-type comparisons. Bolten did examine the effect of 16/0 circle hooks, compared to 9/0 J-hooks, on sea turtle captures and found that the 16/0 hook, either offset or non-offset, did not reduce captures of loggerheads. Fishing in the Azores, Bolten did not have high enough leatherback encounter rates to develop any conclusions on effects of 16/0 hooks for leatherbacks. In the NED experiment, where leatherback encounters were much more frequent, 16/0 circle hooks were not investigated for sea turtle effects, because of Bolten's earlier negative results with loggerheads. Watson et al. (2004b) postulate convincingly that the reduction in leatherback captures seen in the NED experiment with the 18/0 circle hook is the result of the circle hook's shape alone and not a function of its size; therefore, the bycatch reduction rate of the 16/0 circle hook should be equivalent to the 18/0 circle hook. We believe that this reasoning is likely correct, although it has not been empirically demonstrated.

Because of the concern over economic impacts in tuna- and swordfish-directed components of the longline fishery outside the NED, the proposed action will require the use of 16/0, non-offset, or 18/0 or larger, with up to 10 offset, circle hooks. The 16/0 hook has been proven to be successful for tuna-directed fisheries, even though it has not been much used in the U.S. longline fleet, while the 18/0 hook has not been fully tested. Giving fishermen the option of using the smaller circle hook is intended to minimize the risk of adverse economic consequences to fishermen, while still reducing the catch rate of leatherbacks and the post-release mortality rates of loggerheads. This rationale depends on two hypotheses that are reasonable and supported by the best available information, but that have not been scientifically confirmed:

a) Economic impacts to fishermen from required use of the 18/0 or larger circle hook – demonstrated to reduce both loggerhead and leatherback catch rates – would be severe, compared to current industry-standard J-hooks, but the economic impacts from required use of the 16/0 circle hook – demonstrated not to reduce loggerhead catch rates and believed, but not yet demonstrated, to reduce leatherback catch rates – would be more acceptable; and

b) Leatherback catch rates on 16/0 and 18/0 circle hooks would be equivalent.

Also in this opinion, we have made conservative decisions on the use of offset hooks, even though the databases to compare the effects of non-offset vs. 10 offset hooks are small. Additional research on the effect of offsetting hooks is needed to determine how significant a factor hook offsets are in turtle catch rates. If 10 offsets can be demonstrated not to increase turtle catch rates significantly, then our assessment of turtle impacts could be less pessimistic. Also, restrictions on the use of offset hooks could potentially be eased, improving acceptance of the required circle hooks by the U.S. longline industry and possibly other fleets as well. On the other hand, if our conservative decision is confirmed, there would be less question about the necessity of the current offset restrictions in the proposed action, again, both domestically and internationally.

It is critical to validate these assumptions. NOAA Fisheries must ensure that the long-term implementation of the proposed action is at least as effective for leatherback take reduction as we have assumed in this opinion (a 50% reduction compared to U.S. longline industry-standard practice). In addition, while this opinion focuses on the effects just of the U.S. Atlantic longline fleet, the sea turtle population impacts from the longline fleets of other nations, both in the Atlantic and globally, are much more severe than the effects of the U.S. fleet. Convincing other nations to adopt comparable gear and/or bait modifications to reduce the impacts of the global longline fleets is essential if there is to be hope of conserving leatherback and loggerhead turtles globally. And convincing those other nations will likely depend on solid information on target-species catch effects. As long as uncertainty remains about the economic effects of the use of the 16/0 or the 18/0 circle hook, there is little hope that the international longline fleets will adopt alternate fishing gear and therefore little hope of achieving significant threat reduction for sea turtles from international longline gear. NOAA Fisheries must undertake a research project, with an expected completion date of December 31, 2006, to address these outstanding uncertanties.

8.1.3.1 Evaluation of Leatherback Bycatch

NOAA Fisheries must conduct experiments and/or monitoring of the longline fishery to confirm whether the assumed bycatch reduction rate of leatherbacks with the use of the 16/0 circle hook is equivalent to the 18/0 circle hook by:

a) comparison of the effects of the 16/0 and 18/0 hooks in controlled fishing experiments, or

b) comparison of the effects of the 16/0 hook to the former status quo hooks in controlled fishing experiments, or

c) comparison of fishery dependent data.

8.1.3.2 Evaluation of Effect of Offset Circle Hooks

NOAA Fisheries must conduct experiments and/or monitoring of the longline fishery to determine more precisely the effect of offsets up to 10 on rates of sea turtle bycatch, hooking location, and post-release mortality by:

a) comparison of the effects of the 16/0, non-offset and 16/0, 10 offset circle hooks in controlled fishing experiments, or

b) comparison of the effects of the 18/0, non-offset and 18/0, 10 offset circle hooks in controlled fishing experiments.

8.1.3.3 Evaluation of Economic Impacts

NOAA Fisheries must conduct experiments and/or monitoring of the longline fishery to verify the target species catch effects of the 18/0 circle hook in tuna-directed fishing by either:

a) comparison of the effects of the 16/0 and 18/0 hooks in controlled fishing experiments, or

b) comparison of the effects of the 16/0 hook to the former status quo hooks in controlled fishing experiments.

8.1.3.4 Principles for Conducting Evaluations

NOAA Fisheries must continue its successful practice of working cooperatively with government and academic researchers, the U.S. longline industry, and foreign partners to accomplish the required research effectively, efficiently, and with broad buy-in. The SEFSC, the Southwest Fisheries Science Center, and the Pacific Islands Fisheries Science Center are the most likely actors within NOAA Fisheries to carry out these evaluations; they are encouraged to collaborate with each other and their external partners in developing actual research designs. Separate evaluations may be combined in individual projects for efficiency. In particular, sea turtle and target species evaluations may be particularly amenable to combined study.

In selecting among the various alternatives and designing actual experiments, NOAA Fisheries will be cognizant that some catch rate effects will be difficult to detect because of the low rates of catch and bycatch in the pelagic longline fishery, and the high variability in those rates. Experiments looking at negative effects (i.e., intended to support a conclusion that two rates are *not* different), in particular, will be carefully statistically designed with an understanding of the power of the test and an understanding that decisions involving conservation of endangered and threatened species are to be risk-averse. That is, statistical analysis of sea turtle catch effects shall err on the side of assuming an adverse effect does exist or a beneficial effect does not exist, rather than the converse.

Research funded or implemented by NOAA Fisheries may be subject to permit requirements under the ESA or the MSA. NOAA Fisheries conducts section 7 analyses on the issuance of any such permits. Some of the research may not require additional authorizations or section 7 analysis, however, if it would involve fishing with allowed gear (under the requirements of the proposed action) and interventions with any bycaught sea turtles would be consistent with the proposed action and the currently authorized operation of the pelagic observer program or any other properly authorized research program.

8.1.3.5 Application of Evaluation Results

Within 3 months of the completion of each fishing season (i.e., before April 2005, April 2006, and April 2007), NOAA Fisheries must analyze the results of the previous years' scientific experiment (or require reporting from government-funded researchers) for the effects of all the tested parameters on sea turtle and target species catch rates. The research results must be communicated and coordinated with research partners and other interested parties in a timely manner, so that continuing research might be adapted or modified appropriately.

HMS Division must evaluate the interim and final research results against the requirements of the proposed action. HMS Division must consider the possible application of the results through rulemaking to modify the proposed action, if necessary to reduce sea turtle interactions or improve fishery economic performance. Because element 2 of this RPA (section 8.1.2) is designed to limit sea turtle interactions to prevent long-term exceedance of authorized take levels, we do not perceive a need at this time to mandate application of the evaluation results in any particular way. We expect, however, that the evaluation results would be critical to HMS being able to take corrective action that would be minimally disruptive to the fishery, in the event that estimated takes are projected to exceed the authorized takes.

8.1.4 Take Corrective Action to Prevent Long-Term Elevated Take and Mortality

8.1.4.1 Implement Adaptive Management Strategy to Prevent Exceedance of 3-Year ITS

The ITS accompanying this opinion specifies authorized incidental take levels for sea turtles, over three-year periods, beginning with 2004. The final annual reports of take estimates prepared by the SEFSC will be the basis for assessing actual vs. authorized takes. During the course of each three-year period, the HMS Division must review each quarterly and annual report as soon as it becomes available. If these reports indicate that the fishery is not likely to stay within the authorized three-year take levels, the HMS Division must take protective/corrective action to avoid long-term elevations in sea turtle takes and ensure that take levels in the ITS are not exceeded. Such actions may include time-area closures, additional gear modifications or restrictions, or any other action deemed appropriate. HMS Division should consider establishing a rule that would allow implementation of corrective measures through framework action. Such a rule would provide industry with greater certainty on the types of management responses that may occur and would allow for more timely action, reducing the need for later, more drastic action.

8.1.4.2 Reduce Near-Term (2004-2006) Mortality of Leatherbacks by Reducing Fishery Interactions, If Necessary

The conservation measures in the first and third elements of this RPA will be carried out over the next two-and-a-half years. The post-release mortality reduction is not expected to be fully effective until 2007. Likewise, completion of testing that can confirm the effectiveness of the required hook and bait combinations is not required or likely to be completed before 2007. When those elements are successfully implemented, after 2006, long-term average annual capture and mortality of leatherback turtles are expected to be 588 interactions and 84 mortalities, and the three-year authorized incidental take for leatherback turtles would be 1,764 interactions, with a corresponding 252 mortalities. In the meantime, however, mortality will be quite a bit higher as gear removal and post-release survival incrementally improve. Estimated three-year capture and mortality of leatherbacks for 2004-2006 would be 1,981 interactions and 548 mortalities. The 548 mortalities in 2004-2006 would be more than double the level expected in 2007-2009 and beyond, and they represent only a 17% reduction in mortalities, compared to the proposed action without the first element of the RPA. Also, the risk to leatherbacks from the proposed action during this initial three-year period will be higher, as the effectiveness of the required hook and bait combinations will not have been confirmed. Therefore, it is particularly important that mortality rates associated with the fishery not be allowed to exceed the targets laid out in the first element of the RPA.

The RPA requirements of section 8.1.4.1 will ensure that total leatherback sea turtle *takes* do not exceed long-term average take rates, over three year periods. HMS Division may also need to take additional management action to reduce leatherback *mortality* in the near-term (2004-2006), while the other elements of this RPA are being implemented and reaching full effectiveness. Because the impacts to leatherbacks during the near-term are already expected to be greater than the future impacts, NOAA Fisheries must monitor post-hooking survival particularly carefully during the next two-and-a-half years. If fleet-wide gear removal rates are not sufficient to meet the performance targets in Table 8.1.1.3, HMS Division must take immediate action to offset the increased mortality rates and bring overall anticipated mortality back down to the level specified in the first element of the RPA. The proposed action and the first element of this RPA already include requirements to use circle hooks, known to reduce leatherback bycatch rates, and to maximize gear removal to maximize post-release survival. Therefore, the only remaining way to achieve further reductions in leatherback mortality in the pelagic longline fishery would be through closures that reduce fishing effort in areas of high leatherback bycatch.

Closure of the Gulf of Mexico to Pelagic Longline Fishing
We believe that most closures of small, discrete areas will not produce significant sea turtle catch reductions because of the relative ease of shifting fishing to nearby areas. For example, HMS Division analyzed an alternative in their DSEIS to close, year-round, a 25,000 nm^2 area in the

central Gulf of Mexico that accounted for about 41% of the fishery's total leatherback takes. The DSEIS estimated, however, that the net reduction in leatherback interactions from that closure would only be about 16%, because fishermen would simply relocate their effort to other areas where leatherback interactions would still occur. Following the June 30, 2000, jeopardy opinion, HMS Division closed an "L-shaped" portion of the NED to reduce sea turtle captures. However, NMFS SEFSC (2001) analyzed the effects of closing only a limited portion of the NED and found that interactions were spread throughout the area and not just a small portion. Consequently, HMS Division's closure of the NED area, following the June 14, 2001, jeopardy opinion, was a total closure.

The Gulf of Mexico fishing area in the second and third quarters (April-September) accounted for fully half of the estimated leatherback bycatch in the longline fishery, based on 2002 observer data. We believe that a large-scale closure of the Gulf of Mexico during that time is the most effective available alternative that will significantly reduce fishing effort – and thus turtle interactions – and likely not simply result in effort displacement. The effect of such a closure would be a 41% reduction in leatherback interactions, annually, if there is no effort redistribution. Some redistribution of longline effort would likely occur, but we believe it will be minimized under the large-area closure scenario. Many Gulf of Mexico-based vessels may convert to other fisheries or stay idle for a six-month closure.

If fleet-wide gear removal rates are not sufficient to meet the performance targets in Table 8.1.1.3, HMS Division must immediately implement a closure for the entire Gulf of Mexico (to minimize redistribution of effort). The timing and duration of the closure must be sufficient to offset, through reduced interactions, the effects of the higher post-release mortality associated with the poor gear removal levels, and may be longer or shorter than the six-month closure discussed above.

Substitution of Equally Effective Alternative Closure
HMS Division may substitute an alternative closure or closures to the required Gulf of Mexico closure, if their analysis shows that the alternative closure(s) would be equally effective at reducing leatherback sea turtle bycatch, after accounting for redistribution of fishing effort. HMS Division may consider whether alternative closure formulations would be more desirable because of reduced socioeconomic impacts, increased bycatch reduction of other species (e.g. loggerhead turtles, billfish, bluefin tuna, undersize target species), or other relevant factors.

Removal of Closure Requirement
The time-area closure(s) may be removed when data collected on gear removal and post-release survival show that fleet-wide interaction types and gear removal rates have met the post-release mortality targets. With successful implementation of the other elements of this RPA, those criteria should be met by early 2007. If they are not met, the closure(s) must remain in effect until they are.

Corrective Action to Achieve Post-Release Survival Targets

If the 2005 and 2006 targets (Table 8.1.1.3) are not achieved, in addition to the closure discussed above, HMS Division must consult with the SEFSC to determine whether there are identifiable problems in training, compliance in the fishery, effectiveness of the circle hooks, or effectiveness of the gear removal tools and techniques. HMS Division must then take corrective action, as appropriate, to ensure that the long-term targets are successfully achieved. If HMS Division and SEFSC determine that the long-term target for leatherbacks cannot be achieved because of some unseen circumstance, HMS Division must determine whether and how it intends to proceed with the continued authorization of the fishery in light of the requirement to avoid jeopardizing the continued existence of leatherback turtles, and inform SERO of its intended course of action.

8.2 Effect of the Reasonable and Prudent Alternative

This RPA includes requirements intended to reduce post-release mortality of sea turtles, improve monitoring of the effects of the fishery, confirm the effectiveness of the hook and bait combinations that are required as part of the proposed action, and take management action to avoid long-term elevations in sea turtle takes. The RPA is designed to reduce the effects of the HMS pelagic longline fishery to a level where they are not likely to appreciably reduce the leatherback sea turtle's likelihood of surviving and recovering in the wild. The measures in the RPA will also necessarily affect the impacts of the action on loggerhead and other hardshell turtles, which were not found likely to be jeopardized by the proposed action. In this sub-section, we will briefly summarize the effects of the proposed action, as modified by the RPA, on all affected species of sea turtles. Then we will specifically evaluate the population effects to leatherback turtles to ensure that the RPA will remove the action's appreciable reduction of the leatherback's likelihood of survival and recovery.

Section 4 of this document explained the anticipated annual take levels and the status quo anticipated post-release mortality rates for each sea turtle species. The first element of the RPA provides measures to minimize post-release mortality over a two-and-a-half year period. The second element of the RPA requires improvements in the monitoring of the fishery's effects. The third element of the RPA requires NOAA Fisheries to undertake a comprehensive research program to confirm the presumed effects of the required hook and bait types. The fourth element of the RPA requires the HMS Division to ensure long-term average take rates are not exceeded. The fourth element also requires careful monitoring of the progress the fishery makes towards maximum gear removal and conditionally requires the closure of the Gulf of Mexico area (or an equivalent alternative) for a period necessary to offset the mortality effects if the fishery does not meet the necessary post-release mortality reduction targets. Table 8.2 summarizes the anticipated take levels and associated mortality based on implementation of the RPA and contrasts it with the mortality associated with the proposed action without the RPA (shown in parentheses). Because the Gulf of Mexico closure is conditional, Table 8.2 does not reflect the effect of a closure in the take levels. The purpose and effect of such a closure would be to reduce the total number of captures and maintain the total estimated mortality.

Table 8.2 Anticipated triennial incidental takes and mortality of listed species in the longline fishery with implementation of the RPA. Total estimated mortality without the RPA is shown in parentheses.

Species	Time Period	Total Captures	Post-Release Mortality	Total Estimated Mortality
Leatherback	2004-2006	1981	32.8% in 2004, declining to 26.2% in 2005, declining to 19.6% in 2006	548 (662)
	2007-2009, 2010-2012...	1764	13.1%	252 (594)
Loggerhead	2004-2006	1869	40.3% in 1st & 2nd Qtrs 2004, declining to 20.2% in 2005, declining to 18.6% in 2006	438 (468)
	2007-2009, 2010-2012...	1905	17.0%	339 (429)
Other hardshells	2004-2006	105	40.3% in 1st & 2nd Qtrs 2004, declining to 20.2% in 2005, declining to 18.6% in 2006	25 (25)
	2007-2009, 2010-2012...	105	17.0%	18 (21)

Long-term mortality under the RPA is reduced by 21% for loggerhead turtles and by 15% for the other hardshell species. Because we found in the jeopardy analysis that the mortality of loggerhead, green, Kemp's ridley, hawksbill, and olive ridley turtles under the proposed action is not likely to jeopardize the continued existence of those species, we reach the same conclusion for the reduced level of mortality under the RPA.

Leatherbacks receive even greater benefits from the RPA in reduced total mortality, both over time and compared to the proposed action. In the near-term, 2004-2006, the RPA reduces total estimated mortality by 17% for leatherback turtles. The gains that can be made in the near-term are limited, because 2004 will be at least halfway over before the benefits from the required use of circle hooks will begin to accrue, and because we expect that the benefits from improved sea turtle handling and gear removal will take two-and-a-half years to fully materialize. Long-term, the benefits to leatherbacks from the RPA will be large: a 58% in mortality compared to the proposed action without the RPA.

Our jeopardy analysis for leatherback turtles focused on the action's effects on females. We expect that the effects on males would be the same as on females, with an assumed 50:50 sex ratio and no reason to believe that there is a sex-selectivity in pelagic longline captures of leatherbacks. Female turtles were critical to our analysis, however, as their numbers are most measurable as nesters and their survival more directly affects the species' reproduction. In the analysis, we stated that, "If the mortality were one-time or short-term,... [it] would not have a noticeable effect on the population. Continued year after year..., however, the loss of 50 adult females and 50 subadult females, from a population whose adult females number only in the low tens of thousands, is expected to have appreciable population effects." We also highlighted a number of concerns resulting from aspects of the species' biology, the impacted segments of the population, and the scientific uncertainty about the species' status, the species' life history, and the effectiveness of the hook and bait combinations in the proposed action.

With implementation of the first element of the RPA, continued prosecution of the longline fishery is expected to result, long-term, in mortality of only 21 adult and 21 subadult females annually. This reduced level of mortality represents only 0.5% of the total leatherback mortality from pelagic longline fleets in the Atlantic and the Mediterranean and less than 0.1% of the estimated adult female leatherback population in the Atlantic. In addition, the second and fourth elements of the RPA will ensure that the fishery's effects will not exceed the predicted take levels for three-year periods. Previous monitoring and management of the HMS pelagic longline fishery had allowed significant increases in interactions to go undetected and/or uncorrected for extended periods, increasing the risk posed to leatherback populations. The third element of the RPA further reduces the risk to leatherback populations associated with the proposed action by more definitively confirming the effects of hook and bait combinations and the implications of the sea turtle conservation rulemakings. The third element is also expected to have important conservation implications for sea turtles, beyond just the RPA, by improving the scientific and management arguments available to convince other nations – whose sea turtle impacts are much larger than the HMS pelagic longline fleet's – to adopt hook and bait requirements for sea turtle conservation. The fourth element also provides an important check on the effectiveness of the first element by requiring that closures be implemented if the post-release survival gains are not achieved in a timely manner. Our jeopardy analysis did state that one-year or short-term mortality – at the level of the proposed action – would not have a noticeable population effect, but we were aware that it would be part of a continuing action. Therefore, during the near-term period when mortality will be higher than the long-term target for the RPA, but below the level of the proposed action without the RPA, the fourth element assures that mortality will be tightly controlled and not allowed to exceed the near-term targets. With the near-term risks controlled and long-term annual leatherback mortality reduced to exceedingly low levels, compared to the overall mortality (half-a-percent of longline mortality in the basin) and the population's size (less than a tenth of a percent), we believe that the effects of these losses will be below the threshold where they would produce a detectable change in Atlantic leatherback populations. Taken together, the elements of the RPA are expected to reduce the threat posed by the HMS pelagic longline fishery to leatherback sea turtles to a level where it is unlikely that the proposed action would appreciably reduce the likelihood of the species' survival and recovery. Therefore, we conclude that – if NOAA Fisheries fully implements all of the elements of this RPA – the long-term continued operation of the Atlantic pelagic longline fishery is not likely to jeopardize the continued existence of leatherback sea turtles.

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 ITS.

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, the HMS Division must immediately (within 24 hours, if communication is possible) notify the NOAA Fisheries' Office of Protected Resources should a take of an endangered whale occur.

9.1 Amount or extent of take

We believe that the levels of incidental take shown in Table 9.1 may be expected to occur as a result of the proposed action and the implementation of the RPA. These numbers represent the total takes over three-year periods, beginning with 2004. Total annual takes in the fishery are estimated by the SEFSC based on their pelagic observer program, the NED experiment results, and reported fishing effort. The reasonable and prudent measures specified in this ITS, 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. The HMS Division must immediately reinitiate formal consultation, providing an explanation of the causes of the take exceedance, and review with the SERO PRD the need for possible modification of the reasonable and prudent measures (50 CFR 402.16). The RPA contains specific requirements to prevent the incidental take levels from being exceeded, so take exceedance should only occur under exceptional circumstances.

Table 9.1 Anticipated incidental takes of listed species in the longline fishery

Species	Number Captured from 2004-2006	Number Captured each Subsequent 3-Year Period
Leatherback turtle	1981	1764
Loggerhead turtle	1869	1905
Green, Hawksbill, Kemp's ridley, and Olive Ridley turtle, in combination	105	105

9.2 Effect of the Take

NOAA Fisheries has determined that the level of anticipated take specified in Table 9.1 is not likely to result in jeopardy to the green, hawksbill, Kemp's ridley, olive ridley, or loggerhead sea turtle. This level of take is also not likely to result in jeopardy to leatherback sea turtles when the RPA specified in section 8 is enacted, and the following reasonable and prudent measures are fully implemented. The RPA reduces the level of mortality affecting captured sea turtles, improves monitoring and reporting, requires management action to avoid long-term elevations in sea turtle takes, and confirms the effectiveness of hook and bait combinations.

9.3 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, NOAA Fisheries 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 50 CFR § 402.14 (i)(1)(ii) and (iv) to document the incidental take by the HMS pelagic longline fishery 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 NOAA Fisheries in order for the protection of section 7(o)(2) to apply. NOAA Fisheries has a continuing duty to regulate the activity covered by this incidental take statement. If NOAA Fisheries 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 HMS Division must report the progress of the action and its impact on the species to NOAA Fisheries as specified in the incidental take statement [50 CFR 402.14(i)(3)].

We note that the HMS pelagic longline fishery has been the subject of several previous biological opinions which have specified their own reasonable and prudent measures to monitor and minimize the impacts of incidental take. Most of those reasonable and prudent measures have been permanently implemented by NOAA Fisheries through regulations or as standard operating procedures. In addition, the purpose of HMS Division's February 11, 2004, proposed rule is to reduce the bycatch rates and bycatch mortality of sea turtles in the pelagic longline fishery. Thus, the proposed action already includes many measures to monitor and minimize the impact of the longline fishery's incidental take of sea turtles. Further, the RPA in this opinion contains additional sea turtle conservation measures, necessary to remove jeopardy to leatherback sea turtles, that also monitor and minimize the impact of the proposed action's incidental take of sea turtles. We believe the following reasonable and prudent measures are necessary and appropriate to monitor and minimize the effect of take of listed species considered in this opinion:

a) NOAA Fisheries must improve the understanding of leatherback sea turtle life history and population status and provide updated information to be used in management decisions

b) NOAA Fisheries must continue efforts to better understand sea turtle post-release mortality rates and the factors affecting these rates.

c) NOAA Fisheries must take action to ensure improved compliance with safe handling and release gear required on board.

d) NOAA Fisheries must improve the HMS pelagic longline fishery's compliance with vessel safety requirements to reduce the number of inadequate or unsafe vessels for purposes of carrying an observer and for allowing operation of normal observer function vessels in the fleet.

9.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, NOAA Fisheries 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.

a) *Convene an expert working group on leatherback sea turtles.* By December 31, 2004, NOAA Fisheries must select and assemble a group of population biologists, sea turtle scientists, and life history specialists, and natural resource managers who are known experts on sea turtle conservation issues, especially for leatherback sea turtles. These experts may come from academic, government, industry, and/or non-profit organization backgrounds. This group will be charged with compiling the best, most up-to-date information on leatherback sea turtle life history, ecology, population status, and threats. The information is then to be synthesized and presented in a NOAA technical memorandum to be used as a reference on the ecology and status of leatherback sea turtles in the Atlantic and to provide information to be used in making sound management and conservation decisions.

b) *Leatherback research plan*. NOAA Fisheries must develop and implement a research plan to obtain the necessary demographic data to conduct stock assessment analysis and determine the status of the Atlantic leatherback sea turtle. These include, but are not limited to survivorship in each life history stage, age and growth, age and size at stage, age and size at maturity, fecundity and the associated variability of each, and recruitment and dispersal.

c) *Finalize post-release mortality criteria.* OPR must issue final post-release mortality criteria by December 31, 2004.

d) *Post-release mortality studies.* NOAA Fisheries must initiate a full study of post-hooking mortality of loggerheads based on the results of the pilot study conducted in the NED and begin a pilot study for leatherbacks. NOAA Fisheries has demonstrated the ability to capture control (fishery independent) and treatment (fishery dependent) loggerheads, and should now implement a full study in order to attain an appropriate sample size to compare survival between the two groups. A similar study should be initiated for leatherbacks as well. Results of these studies would refine post-hooking mortality estimates currently used by the OPR.

e) *Compliance with Safe Handling and Release Equipment On Board.* NOAA Fisheries must ensure NOAA Fisheries' Office of Law Enforcement (OLE), in cooperation with the U.S. Coast Guard and state law enforcement partners, receive training on the new safe handling and release equipment requirements and conduct dock-side and at-sea boardings that ensure that the gear is on board.

f) *Compliance with vessel safety requirements for observer coverage.* NOAA Fisheries must establish procedures to notify OLE of any vessel authorized to fish with pelagic longline gear and selected for observer coverage that is found to be inadequate or unsafe for purposes of carrying an observer and for allowing operation of normal observer function. Such vessels are prohibited from fishing without observer coverage. NOAA Fisheries must establish procedures for those vessels issue regulations requiring vessels authorized to fish with HMS pelagic longline gear to notify the OLE and POP when safety problems have been corrected, before the vessel conducts another fishing trip.

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.

(a) *In-water Abundance Studies*. In order to better understand sea turtle populations and the impacts of incidental take in HMS fisheries, NOAA Fisheries 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.

(b) *Population Modeling*. Once reasonable in-water estimates are obtained, NOAA Fisheries should support population modeling or other risk analyses of the sea turtle populations affected by HMS, as well as other, fisheries. This will help improve the accuracy of future assessments of the effects of different levels of take on sea turtle populations.

(c) *International Fisherman Education*. NOAA Fisheries should ensure that the *Sea Turtle Handling Guidelines* and *Careful Release Protocols for Release with Minimum Injury* are translated into various languages (*e.g.,* Portuguese, Spanish, Italian, Greek, Vietnamese, Japanese, Chinese), printed, and distributed appropriately 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 shared sea turtle populations).

(d) *International Negotiations*. NOAA Fisheries should focus efforts on the broader impacts from longline fishing on 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. NOAA Fisheries, 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 and to promote the use of the mitigation measures described in the proposed action. Such existing multi-lateral mechanisms may include ICCAT, the U.N. Food and Agriculture Organization Committee on Fisheries (FAO/COFI), the 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. Another potential additional mechanism includes the Indian Ocean Regional MOU for the Conservation and Management of Sea Turtles. Efforts should focus on strenghthening information collection on rates of sea turtle interactions, promoting bycatch reduction measures that have proven effective, stimulating international research on reducing sea turtle-longline interactions, and promoting the development of binding international mechanisms to address sea turtle-longline interactions. If successful adoption of bycatch reduction measures by foreign fleets does not occur, NOAA Fisheries 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.In addition, NOAA Fisheries 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.

(e) *Enhance understanding of leatherback nesting status.* NOAA Fisheries should examine ways to obtain more accurate, consistent surveys of leatherback nesting beaches in the Guianas, Suriname, and Trinidad. These beaches are by far the largest and most important nesting beaches for leatherbacks in the western Atlantic. A better understanding of the dynamics of these beaches, as well as more consistent data, are necessary to be able to utilize the information to make valid assessments about the population status and trends, and therefore to make better management decisions.

(f) *Effectiveness of MARPOL.* NOAA Fisheries 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.

(g) *Improved method of evaluating take levels.* The SEFSC should devise a probability-based approach or other statistical method to evaluate take in the HMS pelagic longline fishery. Use of such a method, instead of using a single number to indicate exceedance of the ITS, may provide a better approach to evaluating the actual risk of greater than expected take levels occurring. Such an approach would allow NOAA Fisheries to establish a trigger that reduces the likelihood of requiring reinitiation unnecessarily because of inherent variability in take levels (which is expected to be large), but still allows for an accurate assessment of how the fishery is performing versus expectations. Once such a method is devised, SEFSC and SERO-PRD would then consult to determine whether the new approach is biologically valid and equivalent to the current method, and provides a better tool for evaluating and managing takes in the HMS pelagic longline fishery.

11.0 Reinitiation of Consultation

This concludes formal consultation on the continued operation of the HMS pelagic longline fishery, as regulated by the HMS 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, (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 (*i.e.,* proposed quota reduction and limited access rules are changed), 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, the HMS Division must immediately request reinitiation of formal consultation.

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