Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency:	National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Southeast Regional Office (SERO), Sustainable Fisheries Division (F/SER2)
Activity:	The Continued Authorization of Reef Fish Fishing under the Gulf of Mexico (Gulf) Reef Fish Fishery Management Plan (RFFMP), including Amendment 31, and a Rulemaking to Reduce Sea Turtle Bycatch in the Eastern Gulf Bottom Longline Component of the Fishery
Consulting Agency:	NOAA, NMFS, SERO, Protected Resources Division (F/SER3)
Approved by:	Roy E. Crabtree, Ph.D., Regional Administrator
Date Issued:	OCT 13 2009

Introduction

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (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 to result in the destruction or adverse modification of any designated critical habitat of such species. NMFS and the U.S. Fish and Wildlife Service (USFWS) share responsibilities for administering the ESA. When the action of a federal agency may affect a species or designated critical habitat protected under the ESA, that agency is required to consult with either NMFS or USFWS, depending on the species and/or critical habitat that may be affected.

Consultations on most listed species and critical habitat in the marine environment are conducted between the action agency and NMFS. Consultations are concluded after NMFS determines that an action is not likely to adversely affected listed species or critical habitat or issues 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 reasonable and prudent alternatives (RPAs) to the action, if any, that would avoid such impacts. The opinion also includes an incidental take statement (ITS) specifying 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, no incidental destruction or adverse modification of critical habitat can be authorized, and thus, there are no reasonable and prudent measures, only reasonable and prudent alternatives that must avoid destruction or adverse modification.

This document represents NMFS' opinion based on our review of the effects of the continued authorization of reef fish fishing in the U.S. Gulf of Mexico (Gulf) Exclusive Economic Zone (EEZ) on threatened and endangered species and designated critical habitat, in accordance with section 7 of the ESA. This consultation considers the continued authorization of the Gulf reef fish fishery as managed under the Gulf Reef Fish Fishery Management Plan (RFFMP), including all amendments implemented to date and the actions proposed in Amendment 31, and an additional rulemaking to maintain adequate protection for sea turtles until Amendment 31 is effective. NMFS has dual responsibilities as both the action agency under the Magnuson-Stevenson Fishery Conservation and Management Act (MSFMCA) (16 U.S.C. §1801 *et seq.*) and the consulting agency under the ESA. For the purposes of this consultation, F/SER2 is considered the action agency and the consulting agency is F/SER3.

This opinion is based on information provided in sea turtle recovery plans, past and current sea turtle research and population modeling efforts, observer and logbook data, and other relevant scientific data and reports cited in the Literature Cited section of this document.

1.0 Consultation History

Consultation History through 2004

An informal ESA section 7 consultation was conducted on the RFFMP prior to its implementation in 1984. NMFS concluded the management measures proposed in the RFFMP were not likely to adversely affect any listed species under the ESA, but did not analyze the effects of the authorized fishery itself. No designated critical habitat was located in the action area, thus none was affected.

Effects of the Gulf reef fish fishery on endangered and threatened species were considered as part of an April 28, 1989, opinion (i.e., NMFS 1989a) that analyzed the effects of all commercial fishing activities in the Southeast Region. The opinion concluded that commercial fishing activities in the Southeast Region were not likely to jeopardize the continued existence of any threatened or endangered species. The incidental take of 10 Kemp's ridley, green, hawksbill, or leatherback sea turtles (combined); 100 loggerhead sea turtles; and 100 shortnose sturgeon was allotted to each fishery identified in the ITS. The Gulf reef fish fishery (bottom longline and hook-and-line components) and the South Atlantic snapper-grouper fishery were identified collectively as one fishery in the ITS. The amount of incidental take authorized was later reduced in a July 5, 1989, opinion (i.e., NMFS 1989b) to only 10 documented Kemp's ridley, green, hawksbill, or leatherback sea turtles; 100 loggerhead sea turtles; and 100 shortnose sturgeon for *all* commercial fishing activities conducted in Atlantic and Gulf fisheries combined.

Subsequent RFFMP plan amendments, regulatory amendments, and Secretarial amendments approved prior to Amendment 23 were all either consulted on informally and found not likely to adversely affect any threatened or endangered species, or were determined by F/SER2 to have no effect and not warrant consultation. All of these actions were found to not change the prosecution of reef fish fishery in any manner that would significantly alter the potential impacts to endangered and threatened species or their designated critical habitats previously considered in the July 5, 1989, opinion.

The 2004/2005 Consultation through August 2008

On August 25, 2004, F/SER2 sent a memorandum to F/SER3 requesting initiation of section 7 consultation on a draft version of Amendment 23 to the RFFMP. The amendment, if implemented, would establish stock status criteria, a rebuilding plan, and needed reductions in harvest for the recreational and commercial sectors of the vermilion snapper family. F/SER2 had determined that the proposed actions, which were expected to reduce the amount of fishing for vermilion snapper would not have an impact not already considered under previous consultations on other fisheries and fishing techniques. F/SER2 requested F/SER3 provide an evaluation of that assessment as soon as possible. The original request was followed up with a second request on November 4, 2004, which included the final version Amendment 23 as an attachment.

F/SER3 concurred with F/SER2's determination that modifications to the RFFMP proposed in Amendment 23 were not expected to modify fishing in a manner that causes an effect to listed species not previously considered. However, formal consultation was reinitiated to consider: (1) new sea turtle bycatch data, (2) information on the status of ESA-listed species and the effect actions have on them that had emerged in the 15 years elapsed since the last formal consultation (i.e., changes to the environmental baseline), and (3) effects on a newly listed species, the smalltooth sawfish. Data collected on recently implemented supplementary discard data forms had confirmed the vertical line (e.g., bandit gear and handline) and bottom longline components of the Gulf reef fish fishery occasionally caught sea turtles. Two lethal sea turtle takes had also been recently observed by Mote Marine Laboratory (MML) biologists aboard a bottom longline vessel fishing for grouper off southwest Florida. Data from the HMS shark bottom longline observer program had also indicated bottom longline gear resulted in the lethal take of sea turtles. Additionally, NMFS listed the U.S. distinct population segment (DPS) of smalltooth sawfish as endangered under the ESA in April 2003. Based on the species' previous capture in bottom longline and other hook-and-line fisheries in the Gulf, NMFS believed the Gulf reef fish fishery might adversely affect smalltooth sawfish.

On February 15, 2005, NMFS completed the new opinion. The opinion (hereafter, the 2005 opinion or NMFS (2005a)) concluded that the continued authorization of the Gulf reef fish fishery managed under the RFFMP was not likely to jeopardize the continued existence of green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtles or smalltooth sawfish. An ITS was issued specifying the amount and extent of anticipated take on a three-year basis, along with RPMs and associated terms and conditions deemed necessary and appropriate to minimize the impact of these takes. Other listed species were found to be not likely to be adversely affected. No critical habitat overlapped with the action area, thus none was affected.

Subsequent to NMFS (2005a), there were several additional RFFMP plan amendments and regulatory amendments determined by F/SER2 to have no effect and not warrant reinitiation of consultation.

Present Consultation

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

On September 3, 2008, F/SER2 requested reinitiation of ESA section 7 consultation on the RFFMP. The request was based on a preliminary analysis conducted by the NMFS Southeast Fisheries Science Center (SEFSC) of recent observer data. The SEFSC's preliminary analysis indicated that the overall amount and extent of incidental take for sea turtles specified in the incidental take statement of the 2005 opinion on the reef fish fishery had been exceeded by the bottom longline component of the fishery. On October 8, 2008, SERO received a copy of the final report, "Estimated Takes of Sea Turtles in the Bottom Longline Portion of the Gulf of Mexico Reef Fish Fishery July 2006 Through 2007 Based on Observer Data" (NMFS SEFSC 2008). The report confirmed that loggerhead sea turtle takes had been substantially exceeded by the commercial bottom longline sector and that consultation needed to be reinitiated.

On October 28, 2008, SERO notified the Gulf of Mexico Fishery Management Council (Gulf Council or GMFMC) that the 2005 opinion ITS had been exceeded and that SERO needed to develop a new opinion for the fishery. SEFSC staff presented a summary of their final report. F/SER3 staff reviewed loggerhead status and recovery progress, general information on opinions and jeopardy analyses, NMFS (2005a), and examples of how other federal fisheries with sea turtle bycatch problems have reduced their impacts. F/SER3 informed the Gulf Council that, based on nesting trends and recovery criteria, the level of mortality in the fishery appears to be a serious concern and is within the bycatch and mortality levels that have warranted management actions in other fisheries to reduce those impacts. In response to this new information, the Gulf Council passed a motion to prepare a scoping document for an amendment to address sea turtle and longline interactions, indicating a desire to consider time/area closures, gear modifications, alternative baits, observer program modifications, and effort limitations.

An interdisciplinary planning team (IPT) consisting of NMFS and Council staff was subsequently formed to assist the Gulf Council in preparing the amendment and the associated National Environmental Policy Act (NEPA) documentation for this action. The IPT prepared a draft scoping document, and scoping meetings were held on December 10 and 11, 2008 (73 FR 70982). Options for rulemaking were presented for Gulf Council review at its January 2009 meeting (74 FR 432), during which the Gulf Council selected actions and alternatives for incorporation into a draft amendment to the RFFMP, Amendment 31. The Gulf Council also requested NMFS put in place a temporary emergency rule to reduce the sea turtle bycatch in the Gulf bottom longline component of the reef fish fishery in the short-term while they continued to develop Amendment 31 to address the problem in the long-term. On January 9, 2009, after extensive review of NMFS SEFSC 2008 and on-going activities in the Gulf reef fish fishery, NMFS determined that continuing to authorize the fishery during the reinitiation period would not violate Section 7(a)(2) or Section 7(d) of the ESA.

On February 24, 2009, F/SER3 notified F/SER2 that additional information would be required for the reinitiated consultation. F/SER3 requested F/SER2 prepare a description of the fishery reflecting the best available information on the operation and management of the fishery, including all reef fish amendments implemented or already proposed subsequent to completion of NMFS (2005a). Also, because the anticipated rulemaking associated with Amendment 31 was expected to change significantly the extent and the manner in which the bottom longline component of the reef fish fishery interacts with sea turtles, F/SER3 indicated the consultation and new opinion would need to be coordinated with the rulemaking. F/SER3 requested written notification of what new proposed measures should be incorporated into the proposed action for consideration in the opinion.

At its April meeting, the Council approved Draft Amendment 31 for public hearings. Following the April Council meeting, FSER2 provided F/SER3 with a list of actions and alternatives under consideration, as well as an updated description of the fishery.

Per the Gulf Council's request, NMFS published a temporary emergency rule on May 1, 2009, to reduce the incidental take and mortality of sea turtles in the bottom longline component of the reef fish fishery in the Gulf of Mexico EEZ while the Council completed Amendment 31 (74 FR 20229, May 1, 2009). Effective May 18, 2009 through October 28, 2009, the rule prohibited the use of bottom longline gear to harvest reef fish east of 85°30'W longitude in waters less than 50 fathoms until the 2009 deepwater grouper and tilefish quotas were met and in water of all depths east of 85°30'W longitude thereafter. In the rule, NMFS specified that if it determined that less restrictive measures would suffice to adequately reduce turtle takes by the longline component of the reef fish fishery, NMFS could rescind the closure before the 180-day effective period of the emergency rule was reached and potentially implement less restrictive measures.

Throughout development of Amendment 31, F/SER3 provided advice and technical assistance on its potential effects on listed species. During this time, F/SER2 and F/SER3, in cooperation with SEFSC, worked to assemble the best available data on sea turtle distribution and abundance in the eastern Gulf of Mexico; the nature of sea turtle interactions in the bottom longline component of the fishery; and potential solutions to reduce these interactions and conserve sea turtles. F/SER2 made several requests for additional information found necessary to complete the consultation.

On April 3, 2009, SERO received updated bottom longline take estimates from the SEFSC, which included revised observer and effort data through 2008 (i.e., NMFS SEFSC 2009a). On May 19, 2009, the NMFS Office of Science and Technology provided SERO results obtained from a statistical analysis of sea turtle data collected in the 2006 Marine Recreational Fishery Statistics Survey Angler Intercept Survey for the Gulf sub-region (NMFS OST 2009). On June 2, 2009, the SEFSC provided F/SER2 with take estimates for the commercial vertical line component of the reef fish fishery (i.e., NMFS SEFSC 2009b). Also on June 2, 2009, SERO received a draft presentation describing the results of a new loggerhead sea turtle population assessment. After reviewing this new information, SERO made several follow-up analysis requests.

SEFSC presented the loggerhead assessment to the Gulf Council's Reef Fish Committee at its June 16, 2009, meeting (NMFS SEFSC 2009c). The Gulf Council's Reef Fish Committee also received a consultation assessment presentation from SERO. The Council deferred taking final action on Amendment 31 during the meeting so its Scientific and Statistical Committee (SSC) could have a chance to review it and advise them on the new loggerhead assessment and other data presented to it at its June meeting.

On July 29, 2009, the SSC met in Tampa, Florida, at the request of the Gulf Council to (1) review the supporting literature and analyses pertaining to Amendment 31; (2) review the adequacy of the scientific information for loggerhead sea turtle population parameter estimates, longline bycatch and management action; and (3) make recommendations as it deemed appropriate and feasible. The SSC received presentations on supporting literature and analyses pertaining to Amendment 31 and loggerhead population status. These presentations and a summary of the SSC's comments and recommendations were included in the August briefing book, available on the Gulf Council's website (http://gulfcouncil.org).

The Gulf Council met again August 11-13, 2009. During this meeting, the Gulf Council reviewed the SSC's comments and recommendations regarding Amendment 31; the Gulf Council also received an updated presentation on the anticipated effects of Amendment 31 regulations upon effective effort impacting sea turtle takes in the Gulf of Mexico reef fish bottom longline component of the Gulf reef fish fishery. After discussion on and revision of Amendment 31's preferred alternatives, on August 13, 2009 the Gulf Council voted in favor of submitting Amendment 31 to NMFS for Secretarial review and approval.

Amendment 31 proposes the following additional actions to reduce sea turtle take by the bottom longline component of the reef fish fishery: (1) A prohibition on the use of bottom longline gear in the reef fish fishery east of Cape San Blas, Florida, inshore of the 35-fathom contour from June through August; (2) a reduction in the number of bottom longline vessels operating in the fishery through an endorsement provided only to longline vessel permits with a demonstrated history of landings, on average, of at least 40,000 pounds of reef fish annually with fish traps or longline gear during 1999-2007; and (3) restriction of the total number of hooks that may be possessed onboard each bottom longline vessel to 1,000, only 750 of which may be rigged for fishing.

On August 28, 2009, the Southeast Regional Administrator requested F/SER3 consider, as part of the proposed action in the opinion being developed for the continued authorization of the fishery, the impacts on loggerhead sea turtles and other protected resources of a potential additional rulemaking that would (1) prohibit the use of bottom longline gear in the reef fish fishery east of Cape San Blas, Florida, inshore of the 35-fathom contour and (2) restrict the number of hooks that may be possessed onboard each vessel to 1,000 hooks total, only 750 of which may be rigged for fishing. The purpose of the additional rulemaking would be to support the continued operation of the bottom longline component of the reef fish fishery while maintaining adequate protection for loggerhead sea turtles until the Gulf Council's preferred management strategy could be implemented. The rulemaking would be designed to be as consistent as possible with the actions proposed in Amendment 31, but omit the seasonal element from the 35-fathom contour prohibition to compensate for the inability to expedite implementation of the proposed permit endorsement. The emergency rule currently in place is set to expire on October 28, 2008. A final rule implementing Amendment 31, if approved, is not expected to be effective until April 2010. The preceding rulemaking would be implemented on or before the expiration of the emergency rule, and would remain effective until superseded by implementation of Amendment 31 or other sea turtle bycatch reduction measures.

On September 17, 2009, F/SER2 provided F/SER3 a summary of estimated reductions in longline effort for 2009 and 2010 associated with the management alternatives being considered.

In summary, this reinitiated consultation evaluates the continued authorization of reef fish fishing under the RFFMP, including the emergency rule closure now in effect, the preferred alternatives of Amendment 31, and the additional rulemaking, as described above.

2.0 Description of the Proposed Action

F/SER2 is proposing to implement Amendment 31, prepared by the GMFMC and the SERO, and an additional rulemaking, prepared by SERO, for the continued authorization and management of the Gulf reef fish fishery. Amendment 31 would allow continued, but more limited, participation by the bottom longline component of the reef fish fishery and is intended to reduce the number of sea turtles takes in the fishery. Specifically, Amendment 31 would modify the

RFFMP and associated regulations at 50 CFR Part 622 under the authority of the MSFCMA to: (1) prohibit the use of bottom longline gear in the reef fish fishery east of Cape San Blas, Florida, inshore of the 35-fathom contour from June through August; (2) reduce the number of bottom longline vessels operating in the fishery through a longline endorsement provided only to vessel permits with a demonstrated history of landings, on average, of 40,000 pounds of reef fish annually with fish traps or longline gear during 1999-2007; and (3) restrict the number of hooks that may be possessed onboard each vessel to 1,000 hooks total, only 750 of which may be rigged for fishing. The final rule implementing Amendment 31, if approved, is expected to be in effect by April 2010. To support the continued operation of the bottom longline component of the reef fish fishery while maintaining adequate protection for loggerhead sea turtles until Amendment 31 can be implemented, the additional rulemaking would (1) prohibit the use of bottom longline gear in the reef fish fishery east of Cape San Blas, Florida, inshore of the 35-fathom contour, and (2) restrict the number of hooks that may be possessed onboard each vessel to 1,000 hooks total, only 750 of which may be rigged for fishing.

NMFS operates under mandates to minimize bycatch to the extent practicable and to protect endangered and threatened species. The MSFMCA is the principal federal statute governing the management of U.S. marine fisheries. National Standard 9 of the MSFCMA requires that conservation and management measures shall, to the extent practicable, (a) minimize bycatch and (b) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch. The bycatch reduction and monitoring requirements in the MSFCMA apply to a broad range of living marine species, including sea turtles. The ESA requires that all federal agencies carry out conservation programs for species that are endangered or threatened with extinction, and conserve the ecosystems on which these species depend. NMFS, as the primary agency responsible for implementing the ESA for marine species, has additional responsibilities and authorities under the ESA, including developing and implementing recovery plans, issuing protective regulations, conducting consultations with other federal agencies, and enforcing the statute. Implementation of Amendment 31 and the additional rulemaking are needed to support the conservation of threatened loggerhead sea turtles in compliance with the ESA and to reduce sea turtle bycatch and bycatch mortality in compliance with National Standard 9 of the MSFMCA. The actions are designed to reduce bycatch of sea turtles in the eastern Gulf of Mexico by the bottom longline component of the Gulf reef fish fishery.

When consulting on FMP actions, NMFS must consider not only the effects of the specific proposed management measures but also the effects of all fishing activity authorized under the FMP. A detailed description of the bottom longline component of the Gulf reef fish fishery is provided in Section 3.2 of Amendment 31. While this action focuses on the commercial bottom longline component, the commercial sector also uses other gears to harvest reef fish, such as vertical lines and spear gear. In addition, the Gulf reef fish fishery has a major recreational component that for some species can account for over 50 percent of the harvest. Therefore, the following subsections will provide a summary of the overall characteristics of the entire Gulf reef fish fishery that is authorized under the RFFMP relevant to the analysis of its potential effects on threatened and endangered species.

2.1 Overview of Management and Regulations

The Gulf reef fish fishery represents one of the earliest fisheries of any consequence for demersal or pelagic fish in the Gulf. The first accounts record their exploitation in an organized fashion starting in the 1850s. Originally, the emphasis centered on snapper, particularly red snapper, and grouper catches were mainly treated as a by-product and sold at a much lower price. However, as a result of the leveling off of snapper catches and growing consumer recognition of grouper as a desirable food item, groupers and snappers became generally interchangeable in the marketplace by the mid- to late-1960s. As fishers extended geographically and particularly with the advent of the sizeable recreational fishery, so did the composition of the catch, and today the overall directed incidental reef fish catch includes snappers, groupers, and other reef fish species. Although these species differ substantially in morphology, range, habitat, behavior, and demographics, these species are all caught by similar methods and can be logically considered one single fishery for management purposes (GMFMC 1981).

The RFFMP was one of the first FMPs developed by the GMFMC. Implementation of the RFFMP was initiated in November 1984. Reef fish identified and managed under the original RFFMP included 14 species of snappers (*Lutjanidae*), 15 species of groupers (*Serranidae*), and 3 species of sea basses *(Serranidae*). Subsequent amendments to the RFFMP added 5 species of tilefish (*Branchiostegidae*), 2 species of jacks (*Carangidae*), white grunt *(Haemulon plumieri*), red porgy (*Pagrus pagrus*), and gray triggerfish (*Balistes capriscus*) (note: red porgy and white grunts were subsequently removed from the fishery management unit). Grouper species are divided into two management units: the shallow-water grouper (SWG) management unit, including black grouper, gag grouper, red grouper, Nassau grouper, yellowfin grouper, yellowmouth grouper, rock hind, red hind, speckled hind, and scamp (until the SWG quota is filled); and the deepwater grouper (DWG) management unit, defined as misty grouper, snowy grouper, yellowedge grouper, warsaw grouper, and scamp (once the SWG quota is filled).

The primary problem identified in the original RFFMP was that a substantial decline in reef fish stocks had occurred in some areas under the GMFMC's jurisdiction. Overfishing in many areas of the Gulf by both recreational and commercial users was identified as a known factor in the decline. Other factors identified as potentially contributing to the decline in reef fish stocks included: (1) a reduction in habitat from both natural and man-made causes; (2) a large bycatch in other fisheries; and (3) major environmental changes. Expanded competition between users competing for the resource and the space the resource occupies was also identified as a problem. The RFFMP attributed this to: (1) increasing fishing effort and the concentration of that effort in localized areas; (2) increasing fishing effort in other fisheries that have a bycatch of reef fish; (3) declining catch per unit effort in some areas; and (4) introduction of new gear.

The goal of the RFFMP (GMFMC 1981) was "[t]o manage the reef fish fishery of the United States waters of the Gulf of Mexico to attain the greatest overall benefit to the Nation with particular reference to food production and recreational opportunities on the basis of maximum sustainable yield as modified by relevant economic, social or ecological factors." Specific objectives in the RFFMP included: (1) to rebuild the declining reef fish stocks wherever they occur within the fishery; (2) to conserve and to increase reef fish habitats in appropriate areas and to provide protection for juveniles while protecting existing and new habitats; and (3) to minimize user conflicts between user groups of the resource and conflicts for space. Since implementation of the original RFFMP, a large number of amendments have been implemented to achieve the goals and objectives set forth in the RFFMP and as modified in various amendments. Management objectives and the respective FMP or amendment establishing each are listed in Table 2.1.

Table 2.1 RFFMP Management Objectives and FMP/amendment establishing the objective.

Management Objective	FMP/Amendment
1. Rebuild the declining reef fish stocks wherever they occur within the fishery.	Original FMP November 1984
2. Establish a fishery reporting system for monitoring the reef fish fishery.	Original FMP
3. Conserve reef fish habitats and increase reef fish habitats in appropriate areas and provide protection for juveniles while protecting existing and new habitats.	Original FMP
4. Minimize conflicts between user groups of the resource and conflicts for space.	Original FMP
5. Stabilize long-term population levels of all reef fish species by establishing a certain survival rate of biomass into the stock of spawning age to achieve at least 20 percent spawning stock biomass per recruit.*	Amendment 1 January 1990
6. To reduce user conflicts and nearshore fishing mortality [modifies Objectives 4].	Amendment 1
7. To re-specify the reporting requirements necessary to establish a data for monitoring the reef fish fishery and evaluating management actions [modifies Objective 2].	Amendment 1
8. To revise the definitions of the fishery management unit and fishery to reflect the current species composition of the reef fish fishery.	Amendment 1
9. To revise the definition of optimum yield to allow specifications at the species level.	Amendment 1
10. To encourage research on the effects of artificial reefs.	Amendment 1
11. To maximize net economic benefits from the reef fish fishery.	Amendment 1
12. To avoid to the extent practicable the “derby” type of fishing season.	Amendment 8 July 1995
13. To promote flexibility for the fishermen in their fishing operations.	Amendment 8
14. To provide for cost-effective and enforceable management of the fishery.	Amendment 8
15. To optimize net benefits to the fishery [modifies Objective 11].	Amendment 8

*Identified as the primary objective of the RFFMP

Numerous permit and reporting requirements, commercial and recreational species regulations, gear restrictions, and other miscellaneous regulations have been implemented over the years to manage the Gulf reef fish fishery. Federal fishing permits are required for any vessel engaging in commercial and for-hire fishing for Gulf reef fish in the EEZ. A moratorium on commercial permits has been in place since May 1992 and a moratorium for charter and headboat permits since July 2002. The RFFMP also includes an individual fishing quota (IFQ) program for red snapper and an IFQ program for groupers (Amendment 29) as well as a grouper bottom longline endorsement program (this action).

The harvest of many of the Gulf reef fish management unit species are managed with minimum size limits, recreational bag limits, commercial trip limits, quotas, and various time, area, and/or gear-based fishing prohibitions and restrictions. Certain species in the fishery are managed individually (e.g., red snapper, vermilion snapper, and greater amberjack), while others are managed within groups or complexes (e.g., SWG, DWG, tilefishes). Commercial reef fish fishing is managed primarily using "hard quotas" (i.e., fishery closures when monitoring indicates commercial quotas are harvested). Quotas have been established for SWG, red grouper, gag, DWG, red snapper, vermilion snapper, greater amberjack, tilefish, and gray triggerfish. Recreational reef fish fishing is managed primarily using minimum size limits and bag limits, but other regulations apply as well. A complete history of management of the reef fish fishery is provided in Appendix 1. A summary of permit and reporting requirements, commercial and recreational species regulations, gear restrictions, and area closure regulations are provided in the following tables (i.e., Tables 2.2 through 2.4). All of these regulations are compiled in 50 CFR Part 622.

Table 2.2 RFFMP Permit and Reporting Requirements

Permit Type	**Activity Required For**
Reef fish permit	Harvest and sale of all reef fish listed in the RFFMP under quota (where applicable) and in excess of the bag limits (where applicable), except goliath grouper and Nassau grouper (for which all harvest is prohibited). Issuance of new reef fish permits is under a moratorium. Existing permits are transferable.
Charter vessel/headboat reef fish permit	Charter vessels and headboats fishing for snappers, groupers, amberjack, tilefish, hogfish, and gray triggerfish. Issuance of new permits is under a moratorium. Existing permits are transferable.
*Current regulations (50 CFR Part 622.5) require commercial and recreational for-hire participants in the Gulf reef fish fishery who are selected by the Southeast Science and Research Director (SRD) to maintain and submit a fishing record on forms provided by the SRD.	

Table 2.3 Gulf Commercial Reef Fish Species Regulations

Species	**Minimum Size Limit (unless otherwise noted)**	**Trip Limit**	**Quotas/Closed Seasons**
Snappers Red Snapper	13" total length	The Commercial red snapper fishery is now managed under an IFQ system. Anyone commercially fishing for red snapper must possess IFQ allocation and follow the established reporting protocol.	Quota = 2.55 million lbs
Vermilion* Lane Gray (Mangrove) Mutton Yellowtail Mahogany Schoolmaster Dog Cubera Blackfin, Queen Silk, Wenchmen	10" total length 8" total length 12" total length 16" total length 12" total length 12" total length 12" total length 12" total length 12" total length None, None None, None	None None None None None None None None None None, None None, None	
Deep-Water Groupers Misty Snowy Yellowedge Warsaw Speckled Hind Scamp*	None None None None None None	6,000 lbs gutted weight trip limit— for all groupers—deepwater and shallow-water, combined; effective through December 31, 2009. Effective January 1, 2010, the commercial fishery will be managed under an IFQ system, and anyone commercially fishing for grouper or tilefish will need to possess an IFQ allocation and follow the established reporting protocol.	Quota: 1.02 million lbs. gutted weight *Includes scamp after SWG quota is filled
Shallow-Water Groupers Black Gag Red Yellowfin Scamp Yellowmouth Rock Hind Red Hind Protected Groupers Goliath (Jewfish) Nassau	24" total length 24" total length 18" total length 20" total length 16" total length None None None Harvest prohibited		A red grouper quota of 5.75 mp gutted weight is included in the SWG quota. A gag quota of 1.32 mp in 2009, 1.41 mp in 2010, and 1.49 mp in 2011. Is included in the SWG quota. The shallow-water quota is the sum of the gag and red grouper quotas with an additional 0.41 mp allowance for other SWG species.
Gray Triggerfish	14" total length	None	A gray triggerfish quota of 80,000 pounds for 2008, 93,000 pounds for 2009, and 106,000 pounds for 2010.
Hogfish	12" fork length	None	None
Greater Amberjack	36" fork length	None	Closed season during March, April, and May; quota of 0.503 mp
Lesser Amberjack Banded Rudderfish	14" to 22" fork length slot limit	None	None
Tilefishes	None	None	0.44 million lbs. (gutted weight)

Table 2.4 Recreational Species Regulations

Species	Minimum Size Limit (Unless otherwise indicated)	Closed Season	Recreational Daily Bag and Possession Limit
Snappers Red Snapper	16" total length	October 1 through May 31	2/person
Vermilion Lane	10" total length 8" total length	None None	Included in the 20 reef fish aggregate limit Included in the 20 reef fish aggregate limit
Gray Mutton Yellowtail Schoolmaster Cubera Dog Queen Mahogany Blackfin Silk Wenchman	12" total length 16" total length 12" total length 12" total length 12" total length 12" total length 12" total length None None None None	None None None None None None None None None None None	10/person in aggregate bag limit, including all snappers except red, vermilion, and lane.
Groupers Black Gag Red Yellowfin Scamp Yellowmouth Rock Hind Red Hind Yellowedge Misty Snowy Speckled Hind Warsaw Protected Groupers Goliath Grouper (Jewfish) Nassau Grouper	22" total length 22" total length 20" total length 20" total length 16" total length None None None None None None None None Harvest Prohibited	February 1 through March 31.for all SWGs	4/person in aggregate of all groupers except goliath grouper and Nassau grouper. No more than 2 red grouper/person (counts as part of the 4 grouper aggregate bag limit). No more than 2 gag/person (counts as part of the 4 grouper aggregate bag limit). 1 speckled hind and 1 warsaw grouper per vessel (counts as part of the 4 grouper aggregate bag limit).
Hogfish	12" fork length	none	5/person
Gray Triggerfish	14" total length	none	Included in 20 reef fish aggregate limit.
Greater Amberjack	30" fork length	Season could close early in following year if 1.368 mp qutoa met.	1/person
Lesser Amberjack Banded Rudderfish	14" to 22" fork length slot limit	none	5-fish aggregate limit for lesser amberjack and banded rudderfish, excluded from 20 reef fish aggregate limit
Aggregate Reef Fish Bag Limit Species Vermilion Snapper, Goldface Tilefish, Tilefish Lane Snapper, Almaco Jack, Blackline Tilefish Gray Triggerfish, Anchor Tilefish, Blueline Tilefish			20/person of all listed species in aggregate

Reef fish taken under the recreational bag limit may not be sold.
All fish except for bait and oceanic migratory species taken from federal waters must have heads and fins intact through landing. Up to 1½ pounds of finfish per person is exempt from the head and fins intact rule for personal consumption provided the vessel is equipped to cook such finfish.
Persons on qualified charter vessels or headboats with two captains for trips in excess of 24 hours may possess 2 days' bag limits of reef fish species. 1-day bag limits apply on all other species and trips regardless of length.

Figure 2.1 (next page) depicts Gulf seasonal and year-round closures that protect environmental sites of special interest to red and gag grouper and affect certain reef fish fishing activities. There is a permanent closure to use of longline and buoy gears for reef fish harvest inshore of 20 fathoms off the Florida shelf and inshore of 50 fathoms for the remainder of the Gulf (72,300 square nautical miles). Madison/Swanson and Steamboat Lumps Marine Restricted Fishing Areas are sited on gag spawning aggregation areas where all fishing except for surface trolling during May through October is prohibited (219 square nautical miles). The Tortugas North and South Marine Reserves are no-take marine reserves cooperatively implemented by the state of Florida, National Ocean Service (NOS), the Gulf Council, and the National Park Service (185 square nautical miles).

Generic Amendment 3 for addressing EFH requirements, Habitat Areas of Particular Concern (HAPC), and adverse effects of fishing prohibited the use of anchors in HAPCs in the following FMPs: Gulf Shrimp, Red Drum, Reef Fish, Stone Crab, Coral and Coral Reefs in the Gulf, and Spiny Lobster and the Coastal Migratory Pelagic resources of the Gulf and South Atlantic (GMFMC 2005a). Individual reef areas and bank HAPCs of the northwestern Gulf containing pristine coral areas are protected by preventing use of some fishing gear that interacts with the bottom. These areas are East and West Flower Garden Banks, Stetson Bank, Sonnier Bank, MacNeil Bank, 29 Fathom, Rankin Bright Bank, Geyer Bank, McGrail Bank, Bouma Bank, Rezak Sidner Bank, Alderice Bank, and Jakkula Bank (263.2 square nautical miles). Some of these areas were made marine sanctuaries by NOS and these marine sanctuaries are currently being revised. Bottom anchoring and the use of trawling gear, bottom longlines, buoy gear, and all traps/pots on coral reefs are prohibited in the East and West Flower Garden Banks, McGrail Bank, and on the significant coral resources on Stetson Bank. The Florida Middle Grounds HAPC protects pristine soft coral area from use of any fishing gear interfacing with bottom (348 square nautical miles). A portion of the Pulley Ridge HAPC where deep-water hermatypic coral reefs are found is closed to anchoring and the use of trawling gear, bottom longlines, buoy gear, and all traps/pots (2,300 square nautical miles).

The designated Stressed Area for Reef Fish is a permanent closure Gulf-wide of the near shore waters to use of fish traps, power heads, and roller trawls (i.e., "rock hopper trawls") (48,400 square nautical miles). In the Alabama special management zone, fishing by a vessel operating as a charter vessel or headboat, a vessel that does not have a commercial permit for Gulf reef fish, or a vessel with such a permit fishing for Gulf reef fish, is limited to hook-and-line gear with no more than 3 hooks. Nonconforming gear is restricted to bag limits, or for reef fish without a bag limit, to 5 percent by weight of all fish aboard.

Additionally, a weak link in the tickler chain of bottom trawls is required on all habitats throughout the Gulf EEZ (GMFMC 2005a). A weak link is defined as a length or section of the tickler chain that has a breaking strength less than the chain itself and is easily seen as such when visually inspected. Also, an education program on the protection of coral reefs when using various fishing gears in coral reef areas was established for recreational and commercial fishermen.

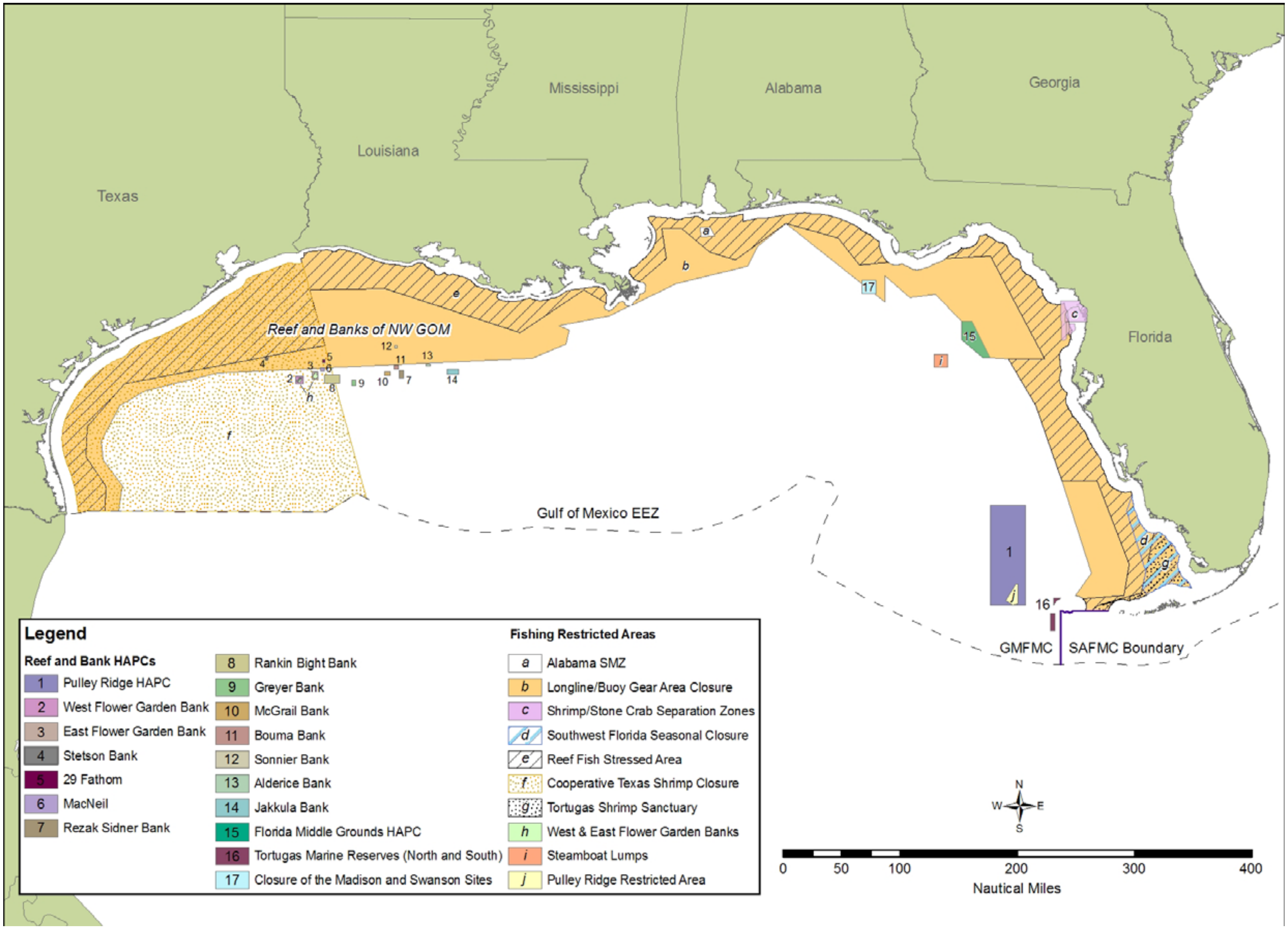

Figure 2.1 Map of most fishery management closed areas in the Gulf of Mexico

2.1.1 Management of Gulf Reef Fish Exempted Fishing, Scientific Research and Exempted Educational Activity

Regulations at 50 CFR 600.745 allow the Southeast Regional Administrator to authorize the targeting or incidental harvest of species managed under an FMP or fishing activities that would otherwise be prohibited for scientific research, limited testing, public display, data collection, exploratory, health and safety, environmental cleanup, hazardous waste removal purposes, or for educational activity. Every year, the SERO may issue a small number of exempted fishing permits (EFPs), scientific research permits (SRPs), and/or exempted educational activity authorizations (EEAA) exempting the collection of a limited number of reef fish from Gulf federal waters from regulations implementing the RFFP. For example, between 2007 and 2008, SERO issued one EFP, two SRPs, and no EEAAs relative to the Gulf reef fish fishery. These EFPs, SRPs, and EEAAs involve fishing by commercial or research vessels, similar or identical to the fishing methods of the Gulf reef fish fishery, which is the primary subject of this opinion. In these cases, the types and rates of interactions with listed species from the EFP, SRP, and EEAA activities would be expected to be similar to those analyzed in this opinion. 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, SRPs, and EEAAs 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 not otherwise accrue from the vessel's normal commercial activities. Similarly, issuance of an EFP, SRP, or EEAA to a vessel to conduct a minimal number of reef fish trips with vertical line (commercial or recreational) or bottom longline gear likely would not add sufficient fishing effort to produce a detectable change in the overall amount of fishing effort in a given year. Therefore, we consider the issuance of most EFPs, SRPs, and EEAAs by the SERO to be within the scope of this opinion. The included EFPs, SRPs, and EEAAs would be those involving fishing consistent with the description of reef fish fishing in Section 2 and which are not expected to increase fishing effort significantly.

2.1.2 Gulf Reef Fish Fishery Monitoring and Reporting

As noted in Table 2.2, current regulations (50 CFR Part 622.5) require Gulf reef fish fishery commercial and recreational for-hire participants selected by the Southeast Science and Research Director (SRD) to maintain and to submit a fishing record on forms (i.e., a logbook) provided by the SRD. Private and charter recreational participants in the Gulf reef fish fishery are monitored mainly by the Marine Recreational Fishery Statistics Survey (MRFSS). Information describing monitoring and reporting by vessel type is presented below.

Commercial vessels
Logbook reports have been required from all vessels with Gulf reef fish permits for commercial fishing for Gulf reef fish since 1993. Catch and effort data per trip is reported via the Coastal Fisheries Logbook Program (CFLP). Information on the quantity (reported in pounds) caught for each species, the area of catch, the type and quantity of gear, the dates of departure and return, the dealer and location (county and state where the trip is unloaded), the duration of the trip (time away from dock), an estimate of the fishing time, and the number of crew is required.

In August 2001, the SEFSC initiated the Supplementary Discard Data Program (SDDP) to address bycatch reporting in Southeast fisheries (Poffenberger 2004). The SEFSC developed a supplemental form that is used with the CFLP logbook to collect discard data as mandated by the Sustainable Fisheries Act. Commercial reef fish fishers are now required, if selected, to report the number and average size of fish being discarded by species and the reasons for those discards (regulatory or market conditions). The bycatch data are collected using a supplemental form sent to a stratified, random sample of the commercial reef fish permit holders (20 percent coverage). Sample selections were originally made in July of each year, and the selected fishermen (vessels) were required to complete and to submit discard forms along with their logbook forms for each trip they made during August through July of the following year. The 2004/2005 reporting period was extended to run from August 2004 to December 31, 2005; all participants selected thereafter were selected on a calendar year basis. The sampling system is designed so that the 20 percent of fishermen selected to report for a given year are not selected for the next four years so that over the course of a 5-year period, 100 percent of reef fish permit holders will have been required to report in one of the five years. Failure to comply with reporting requirements can result in sanctions precluding permit renewal.

Two on-going observer programs provide information on reef fish harvests and bycatch rates. Each program was independently designed and implemented sampling regimes for different, but overlapping portions of the Gulf commercial reef fish fishery. In 2006, NMFS initiated an observer program for the commercial reef fish fishery under Amendment 22 to the RFFMP. The reef fish observer program (RFOP) is administered through the SEFSC, Galveston Laboratory. It utilizes a random selection process, stratified by gear and season, to obtain about 300 observer days of data per season, estimated to be about 2 percent of the commercial reef fish effort (J. Nance and E. Scott-Denton, NMFS Galveston, personal communication). Under this program observers report all catches, including incidental catch of protected resources. The second program is the HMS shark bottom longline observer program (SBLOP). This program places observers on the bottom longline component of the HMS shark fishery and has been in place since 1994 (Burgess and Morgan 2003). It was first administered by the Gulf and South Atlantic Fisheries Foundation/University of Florida; but is now administered by the SEFSC, Panama City Laboratory. Starting in mid-2006, this program not only requires observers to record all catches, including incidental catch of protected resources, but also records the target species group. Therefore, information on trips targeting reef fish can be used for analyses of the reef fish fishery.

For-hire charter vessels and private recreational fishing vessels

Harvest and bycatch in the recreational for-hire charter vessel sector and the private recreational sector have been consistently monitored since 1979. Monitoring is accomplished primarily through MRFSS and the Texas Parks and Wildlife Department's Coastal Sport Fishing Survey[1]. The survey uses a combination of random-digit-dialed telephone intercepts of coastal households for effort information and dock-side intercepts of individual trips for catch information to statistically estimate total trips, catch, and discards by species, for each subregion, state, mode, primary area and wave.[2] Bycatch is enumerated by a disposition code for each fish caught but not kept. Texas conducts its own survey, which provides similar data.

[1]MRFSS covers all Gulf states except Texas.
[2] Waves are two-month sampling periods.

Prior to 2000, sampling of the charter vessel sector resulted in highly variable estimates of catch. However, in 2000 a new charter vessel sampling methodology was implemented. A 10 percent sample of charter vessel captains is called weekly to obtain trip level information. In addition, the standard dockside intercept data are collected from charter vessels, and charter vessel clients are sampled through the standard random digit dialing of coastal households. Precision of charter vessel effort estimates has improved by more than 50 percent due to these changes (Van Voorhees et al. 2000).

For-hire headboats
Harvest from headboats has been monitored by the NMFS, SEFSC, and the Beaufort Laboratory since 1986, but no bycatch information is routinely collected. Prior to 1986, headboats were monitored through the MRFSS. Daily catch records (trip reports) are filled out by headboat operators or, in some cases, by the NMFS-approved headboat samplers based on their personal communications with captains or crew. Headboat samplers sub-sample headboat trips for data on species' lengths and weights. Biological samples (scales, otoliths, spines, gonads, and stomachs) are taken as time permits. Occasionally, onboard headboat samplers will record lengths of discarded fish; however, these trips are rare, and the data do not become part of the headboat database.

2.2 Status of Reef Fish Stocks

The RFFMP currently encompasses 42 species (Table 2.5). Stock assessments have been conducted on 11 species: red snapper (SEDAR 7 2005), vermilion snapper (Porch and Cass-Calay 2001; SEDAR 9 2006a), yellowtail snapper (Muller et al. 2003; SEDAR 3 2003), gray triggerfish (Valle et al. 2001; SEDAR 9 2006b), greater amberjack (Turner et al. 2000; SEDAR 9 2006c), hogfish (Ault et al. 2003; SEDAR 6 2004a), red grouper (NMFS 2002a; SEDAR 12 2007; SEDAR 2009a), gag (Turner et al. 2001; SEDAR 10 2006; SEDAR 2009b), yellowedge grouper (Cass-Calay and Bahnick 2002), and goliath grouper (Porch et al. 2003; SEDAR 6 2004b). A review of the Nassau grouper's stock status was conducted by Eklund (1994), and updated estimates of generation times were developed by Legault and Eklund (1998).

Of the 11 species for which stock assessments have been conducted, the second quarter report of the 2009 Status of U.S. Fisheries (NMFS 2009a) classifies 3 as overfished (greater amberjack, gray triggerfish, and red snapper), and 4 as undergoing overfishing (red snapper, gag, gray triggerfish and greater amberjack). However, a recent stock assessment update for gag (SEDAR 2009b) indicates this species is overfished. Many of the stock assessments and stock assessment reviews can be found on the Council (www.gulfcouncil.org) and SEDAR (www.sefsc.noaa.gov/sedar) websites.

Table 2.5 Species of the reef fish FMP. Species in bold have had stock assessments. *Deep-water groupers (Note: if the SWG quota is filled, then scamp are considered a DWG) **Protected groupers

Common Name	Scientific Name	Stock Status
Balistidae—Triggerfishes		
Gray triggerfish	*Balistes capriscus*	Overfishing, overfished unknown
Carangidae—Jacks		
Greater amberjack	*Seriola dumerili*	Overfished overfishing
Lesser amberjack	*Seriola fasciata*	Unknown
Almaco jack	*Seriola rivoliana*	Unknown
Banded rudderfish	*Seriola zonata*	Unknown
Labridae—Wrasses		
Hogfish	*Lachnolaimus maximus*	Unknown
Lutjanidae—Snappers		
Queen snapper	*Etelis oculatus*	Unknown
Mutton snapper	*Lutjanus analis*	Unknown
Schoolmaster	*Lutjanus apodus*	Unknown
Blackfin snapper	*Lutjanus buccanella*	Unknown
Red snapper	*Lutjanus campechanus*	Overfished overfishing
Cubera snapper	*Lutjanus cyanopterus*	Unknown
Gray (mangrove) snapper	*Lutjanus griseus*	Unknown
Dog snapper	*Lutjanus jocu*	Unknown
Mahogany snapper	*Lutjanus mahogoni*	Unknown
Lane snapper	*Lutjanus synagris*	Unknown
Silk snapper	*Lutjanus vivanus*	Unknown
Yellowtail snapper	*Ocyurus chrysurus*	Not overfishing not overfished
Wenchman	*Pristipomoides aquilonaris*	Unknown
Vermilion snapper	*Rhomboplites aurorubens*	Not overfished not overfishing
Malacanthidae—Tilefishes		
Goldface tilefish	*Caulolatilus chrysops*	Unknown
Blackline tilefish	*Caulolatilus cyanops*	Unknown
Anchor tilefish	*Caulolatilus intermedius*	Unknown
Blueline tilefish	*Caulolatilus microps*	Unknown
(Golden) Tilefish	*Lopholatilus chamaeleonticeps*	Unknown
Serranidae—Groupers		
Dwarf sand perch	*Diplectrum bivittatum*	Unknown
Sand perch	*Diplectrum formosum*	Unknown
Rock hind	*Epinephelus adscensionis*	Unknown
Yellowfin grouper	*Mycteroperca venenosa*	Unknown
Scamp	*Mycteroperca phenax*	Unknown
Red hind	*Epinephelus guttatus*	Unknown
****Goliath grouper**	*Epinephelus itajara*	Unknown not overfishing
****Nassau grouper**	*Epinephelus striatus*	Unknown not overfishing
Red grouper	*Epinephelus morio*	Not overfished not overfishing
Gag	*Mycteroperca microlepis*	Overfishing, overfished
Yellowmouth grouper	*Mycteroperca interstitialis*	Unknown
Black grouper	*Mycteroperca bonaci*	Unknown
***Yellowedge grouper**	*Epinephelus flavolimbatus*	Unknown
*Snowy grouper	*Epinephelus niveatus*	Unknown
*Warsaw grouper	*Epinephelus nigritus*	Unknown
*Misty grouper	*Epinephelus mystacinus*	Unknown
*Speckled hind	*Epinephelus drummondhayi*	Unknown

2.3 Description of the Gulf Reef Fish Fishery

The Gulf reef fish fishery is comprised of both commercial and recreational participants. As noted in Section 2.1, federal fishing permits are required for any vessel engaging in commercial fishing for Gulf reef fish in the EEZ. The number of boats actively participating in the fishery may be considered one measure of effort in the fishery. For the period 1993-2006, the number of commercial boats harvesting at least one pound of reef fish averaged 1,123 vessels (GMFMC 2009). While landings of particular reef fish species have shown patterns of increases and decreases, the number of boats actively participating in the fishery has declined over time. For example, the average number of boats in the fishery fell from an average high of 1,246 for the time period 1993-1998, to an average low of 895 in the period 2005-2006 (GMFMC 2009). The downward trend in the number of boats landing reef fish is partly reflected in the number of trips taken by the remaining boats, but the decline in trips is not as dramatic as that for boats.

The for-hire sector is comprised of charter vessels and headboats (partyboats). Although charter vessels tend to be smaller, on average, than headboats, the key distinction between the two types of operations is that the fee charged on charter boat or trip is for the entire vessel, regardless of how many passengers are carried, whereas the fee charged for a headboat trip is paid per individual angler. A federal for-hire vessel permit has been required for reef fish since 1996 and the sector currently operates under a limited access system (GMFMC 2005b). Prior to the implementation of the current moratorium, NMFS had issued 3,340 permits associated with 1,779 unique vessels. Of these vessels, 1,625 had reef fish permits (GMFMC 2005b). As of March 19, 2009, the number of active for-hire reef fish permits was 1,276.

Participants in the Gulf reef fish fishery primarily target snappers and groupers. Red and gag grouper, red and vermilion snapper, and greater amberjack are the most commonly targeted reef fish species by both commercial and recreational fishermen. The grouper fishery occurs along the northeastern Gulf coast primarily along the west coast of Florida (GMFMC 2008). SWG fishing is concentrated in federal waters 40 fathoms or less, whereas DWG fishing extends beyond 40 fathoms to out as far as 100 fathoms. The snapper fishery occurs along the northern and western Gulf coast, in federal waters generally less than 33 fathoms (GMFMC 2007). Louisiana and Texas account for a majority of the commercial snapper landings, while west Florida and Alabama account for a majority of the recreational snapper landings (GMFMC 2007).

Reef fish fishing occurs year-round; however, during some times of the year, fishing may be closed for some species. Closures can occur because a fishery has met its quota, or due to seasonal closures to constrain fishing effort or protect spawning stocks. Examples of quota closures include the commercial SWG, DWG, and red snapper fisheries. In 2004 and 2005, the SWG fishery closed on November 15 and October 10, respectively, as the red grouper quota was met. Since 2003, the DWG fishery has closed in the late spring to early summer. Examples of seasonal closures to constrain fishing effort would include the recreational red snapper which currently has a fishing season from June 1 until the fishery is projected to reach its quota (August 5 for 2008), and the recreational SWG closure from February 1 to March 31 which will go into effect in 2010 (GMFMC 2007, 2008). An example of a closure to protect spawning is the February 15 to March 15 commercial gag, red, and black grouper closure which was developed to protect gag spawning aggregations. This one month closure will be replaced with a January 1 to April 30 closure of "The Edges," where gag spawning aggregations have been observed (GMFMC 1999, 2008).

Commercial fishermen use several different gears in Gulf federal waters to harvest reef fish including: bottom longline gear, vertical line gear (e.g., handline and bandit gear), and spearfishing gear (see 2.3.2 for gear descriptions). Overall, vertical line gear has the highest use in trips targeting snapper and grouper (GMFMC 2008). Of the 14,698 average annual number of trips taken for reef fish and/or grouper, approximately 79 percent used vertical lines, 12 percent used longlines, and 9 percent used other gear (mostly traps and spearfishing gear; Farmer, pers. comm., SERO). Vessels in the eastern Gulf use bottom longlines and vertical lines to catch primarily groupers. Based on 1993-2006 logbook data, the average annual number of trips reporting the harvest of grouper using bottom longlines (1,298 trips) is relatively small when compared to vertical lines (7,650 trips). However, based on catch data from that same time period, the annual catch of grouper by the use of longlines generally exceeds that of vertical lines by 30 percent to 50 percent. This difference reflects the significantly higher catch per trip for longline trips when compared to vertical line trips. Trap gear was phased out of fishery over a 10 year period ending in February 2007. In the northern Gulf, commercial catches differ by gear with vessels using vertical lines catching primarily snapper (red and vermilion) and vessels using bottom longlines catching primarily DWGs (GMFMC 2004).

From 1993 through 2006, commercial fishing vessels landed an annual average of 18.4 million pounds (MP) whole weight (WWT) of Gulf reef fish species, with an annual nominal ex-vessel value of $40.176 million. For the same period, the commercial fishery landed an annual average of 7.82 MP WWT of SWG, of which 67 percent was red grouper, 18 percent was gag, and the rest was other SWG species. Deep-water grouper landings averaged 1.17 MP WWT during this same time period, of which most was yellowedge grouper. Of the snapper species, red snapper had the highest average landings of 4.29 MP WWT, which is approximately 23 percent of all reef fish landed. Other important species landed by the fishery include vermilion snapper, greater amberjack, and gray triggerfish.

In 2005, more than 3.3 million in-state anglers (anglers who fished within their state of residence) took 23 million trips (inclusive of visitor trips) and caught over 154 million fish. These totals do not include activity occurring solely in Texas (all modes) or in the headboat sector (all Gulf states). More than 70 percent of these anglers fished in Florida, followed by, in decreasing order, Louisiana, Alabama, and Mississippi. Similarly, Florida accounted for a large percentage of the trips (70 percent), followed in order by Louisiana, Alabama, and Mississippi. The most commonly caught non-bait species were spotted seatrout, red drum, gray snapper, white grunt, sand sea trout, sheepshead, red snapper, king mackerel, and Spanish mackerel. Total recreational effort for all species from Florida through Louisiana averaged at 19.5 million trips annually. This effort remained about flat from 1993 through 1996, increased in 1997, but subsequently fell to its lowest level of 15.9 in 1999. It then registered a relatively fast growth in the 2000s.

GMFMC (2008) examined grouper and gag angler effort. For red grouper, target effort averaged 115,855 trips annually. This effort followed a seesaw pattern, falling from 1993 through 1998, increasing from 1999 through 2001, falling again in the next two years, only to increase again in the last two years. Relative to total recreational effort, target effort for red grouper ranged from 0.3 percent (1998) to 0.95 percent (1993), or averaged at 0.59 percent annually. Florida accounted for most of red grouper target trips, with charter fishing accounting for more effort than private trips.

Target effort for gag averaged 297,189 trips annually and ranged from 144,785 trips in 1994 to 580,424 trips in 2005. This effort increased from 1994, and although it fell in 1998, it did recover in subsequent years, with rather steep increases in the last few years. Relative to total recreational effort, target effort for gag ranged from 0.83 percent (1994) to 2.57 percent (2005), and averaged 1.50 percent annually. Florida accounted for most of gag target trips, and with the exception of Alabama, gag target trips were practically non-existent. Although the charter mode is the dominant mode in terms of gag target trips, the shore and private modes also registered a fair amount of gag target trips.

2.3.1 Gear Type Descriptions and Techniques

The primary gears used in the commercial Gulf reef fish fishery are bottom longlines and bandit rigs (a type of vertical line gear). Recreational fishermen predominately target reef fish using rod and reel. Spearfishing also constitutes a small part of both recreational and commercial reef fish fishing. Fish traps were used in the commercial fishery until February 7, 2007, when their use became prohibited in the Gulf of Mexico EEZ. A brief description and potential environmental impacts of each of the gears currently used are provided below.

Vertical line gear

Vertical line gear authorized in the Gulf reef fishery includes bandit gear, rod and reel, handline, and buoy gear (50 CFR 600.725, 64 FR 67511). These gears are defined at 50 CFR Part 622.2. Bandit gear is defined as a rod and reel that remains attached to a vessel when in use from which a line and attached hook(s) are deployed. Rod and reel refers to a rod and reel that is not attached to a vessel or, if attached, is readily removable. In the case of both bandit gear and rod and reel, the line is paid out from and retrieved on the reel manually, electrically, or hydraulically. A handline is defined as a line with attached hook(s) that is tended directly by hand. Buoy gear is defined as fishing gear consisting of a float and one or more weighted lines suspended there from, generally long enough to reach the bottom. A hook or hooks (usually 6-10) are on the lines at or near the end. The float and line(s) drift freely and are retrieved periodically to remove catch and rebait hooks.

Bandit gear generally has 3 to 20 hooks, but can have more, depending upon the species targeted. The line is deployed and retrieved from a large reel fixed to the side of a boat. The early bandit gear was hand-cranked, but now most vessels have electric or hydraulic reels. Bandit gear was first reported used in Fort Pierce, Florida, in 1945. By 1950, it was in extensive use in both the Atlantic and the Gulf of Mexico, and was considered to out-fish handlines by a factor of about 3 to 1 (Siebenaler and Brady 1952). NMFS catch data indicate that for the period 1998-2000 bandit gear was 1.7 times as productive as handline gear. Bandit rigs used for grouper fishing generally are rigged with fewer hooks than those used for snapper fishing. Schirripa et al. (1999) noted that the number of hooks per handline increased from about two in 1990 to nearly nine in 1994, and then declined to three in 1997.

Some commercial and most recreational fishers use rod and reel gear. Deep water fishing typically entails the use of 30-lb test monofilament line with 10 to 15 feet long 40- to 60-lb test monofilament line leaders, and 7/0 hooks (e.g. Mustad #92677) (Poveromo 1998). Gear used in more shallow waters is typically 20-lb test, with 4 to 8 feet long 30-lb test leaders and 4/0 hooks (e.g., Eagle Claw L256). Many fishers in recent years have switched from using J-hooks to circle hooks (NMFS 2005a). Circle hooks became mandatory when fishing for reef fish effective June 1, 2008, under a provision in Amendment 27.

The other authorized vertical line gear types contribute little to the fishery. Handline is not commonly used in the Gulf. Buoy gear was reported to be used in the Gulf reef fish fishery between 1984 and 1992, primarily off Louisiana to target red snapper and yellowedge grouper. The use of buoy gear appears to have dropped off rapidly after the longline and buoy gear boundary was established in 1990. Its infrequent use led the SEFSC to discontinue including a separate column for buoy gear in 1993, and it has not been reported or thought to have been used since then (GMFMC 2009).

Vertical gear fishers rely on finding concentrations of fish within the range of attraction of the few hooks at the terminal end of the gear. Concentrations of many managed reef fish species are higher on hard bottom areas than on sand or mud bottoms, thus this type of fishing generally occurs over hard bottom (GMFMC 2004). In their use, a weighted line is lowered to the bottom, and then the lead is raised slightly off the bottom (Siebenaler and Brady 1952). Thus, the gear is in direct contact with the bottom for only a short period of time. Barnette (2001) suggests that physical impacts may include entanglement and minor degradation of benthic species from line abrasion and weights (sinkers).

Longlines

A longline is defined as any line that is deployed horizontally to which gangions and hooks are attached. Bottom longlines use baited hooks on offshoots (gangions, snoods, or leaders) of a single main line to catch fish found near the bottom. The line uses anchors or weights to keep the gear on the bottom to target primarily demersal species such as reef fishes. The longline is retrieved with a hauler (generally electrical or hydraulic).

Reef fish longlines were initially used in the late 1970s and early 1980s, and by 1982 longline gear was well established in the snapper-grouper fleet. Currently, the bottom longline component of the Gulf reef fish fishery uses mainline material composed of galvanized cable, steel cable or monofilament, ranging in diameter from 3.2 to 4.0 mm (NMFS 2005a). The industry uses a range of mainline lengths, which typically depend on size of the fishing vessel. For example, the average mainline length calculated from 2005-2008 logbook data targeting shallow-water grouper ranged from 6 to 7 nautical miles (NMFS 2009b). The minimum mainline length recorded in logbooks was 1 nautical mile and the maximum was 26 nautical miles (NMFS 2009b). Observers in the RFOP recorded the same average mainline length of 6 nautical miles, but the maximum mainline length observed was 12 nautical miles (NMFS 2009b).

Bottom longline fishermen typically uses gangion material made of monofilament ranging in strength from 200 to 400 pound test (NMFS 2005a) and lengths ranging from 4 to 12 ft. It has been suggested that longer gangions allow the bait to float up so they are more available to some species of fish. Anecdotal evidence suggests the use of longer gangions lends itself towards different fishing practices such as longer soak times.

Hooks averaged 2.2 inches in shaft length and 0.9 inches from the point to the shaft (NMFS 2005a). Logbooks and observer programs do not record the number of hooks per vessel, but instead record the number of hooks per set. Logbook data from 2005 through 2008 show the average number of hooks used per set ranged from 1,000 to 1,200 hooks (NMFS 2009b). Based on fishermen's estimates, the number of hooks used per mile of longline was 100 to 200 hooks by a fleet in Madeira Beach (B. Spaeth, pers. comm. in GMFMC 2009).

Prytherch (1983) reported that the spacing of the gangions varied; if a good catch was anticipated hooks would be set about 10-12 feet apart. However, if an unknown area was being fished the hooks would be set from 20-50 feet apart. The average depth for the 311 sets was 26.6 m (± 14.9 s.d.), with a range of 10 to 70 m. Sets targeting red grouper averaged 18.6 m. Fishing time varies with an average soak time of three hours, defined as the last hook or buoy in the water to the first hook or buoy hauled out of the water (NMFS 2005a; Hale et al. 2007). The majority of fishing occurred during daylight hours; however, lines were set at all hours. The majority of the sets occurred over rock bottom (41 percent), with shell (21 percent), coral (21 percent), unknown (14 percent), pothole depression (3 percent), and mud (<1 percent) comprising the remaining (NMFS 1995a).

Cut squid (e.g., Humboldt squid wings) has typically been used as preferred bait by the bottom longline reef fish fishery component due to its ability for staying on a circle hook, especially at deeper depths (Pingguo 1996). Whole squid are typically not used as bait, due to cost (R. Spaeth, commercial fishermen, pers. comm. in GMFMC 2009). Cut pieces of finfish such as mackerel, Atlantic thread herring, and mullet when economically priced and available are also used for bait in the bottom longline component of the Gulf reef fish fishery (G. Brooks and R. Spaeth, pers. comm. in GMFMC 2009).

Spear and Powerhead

Spearguns and slings are devices that use pneumatic pressure or rubber bands to hurl a spear shaft at the fish. Sometimes a spearfisherman will employ a shotgun or pistol shell known as a powerhead at the shaft tip, which efficiently delivers a lethal charge to their quarry. This method is commonly used to harvest large species such as amberjack. Barnette (2001) cited a study by Gomez et al. (1987) that concluded that spearfishing on reef habitat may result in some coral breakage, but damage is probably negligible. In addition, there could be some impacts from divers touching coral with hands or from resuspension of sediment by fins (Barnette 2001). Such impacts should be negligible to non-existent for well-trained and experienced spearfishermen who stay in the water column and avoid contact with the bottom.

2.4 Action Area

The action area for an opinion is defined as all of the areas affected directly or indirectly by the federal action and not merely the immediate area involved in the action. The Gulf reef fish fishery is managed under the RFFMP throughout the U.S Gulf EEZ, which extends from 9 nautical miles seaward of the states of Florida and Texas, and 3 nautical miles seaward of the states of Alabama, Mississippi, and Louisiana, to 200 nautical miles from the baseline from which the territorial sea of the United States is measured. Throughout this potential range of operation, the Gulf reef fish fishery may affect one or more listed species (detailed discussion in Section 5); therefore, the action area for this consultation includes all of the U.S Gulf EEZ. Specific fishing areas within the action area are determined by a variety of biological (e.g., distribution of reef fish), socio-economical (e.g., market factors, location of ports, operating costs), and regulatory factors (e.g., gear-restricted areas and closed areas). Juvenile and adult reef fish are typically demersal, and are usually associated with bottom topographies on the continental shelf (<100 m) which have high relief, i.e., coral reefs, artificial reefs, rocky hard-bottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings (GMFMC 2004). However, several species are found over sand and soft-bottom substrates. Juvenile red snapper are common on mud bottoms in the northern Gulf, particularly off Texas through Alabama (GMFMC 1998). Also, some juvenile snappers (e.g., mutton, gray, red, dog, lane, and yellowtail snappers) and groupers (e.g., goliath grouper, red, gag, and yellowfin groupers) have been documented in inshore seagrass beds, mangrove estuaries, lagoons, and larger bay systems (GMFMC 1981).

3.0 Status of Listed Species and Critical Habitat

Table 3.1 lists the endangered (E) and threatened (T) species under the jurisdiction of NMFS, which may occur in the action area. There is currently no designated critical habitat in the action area.

Table 3.1 Listed Species and Critical Habitat That May Occur in the Action Area

Common Name	Scientific Name	Status
Marine Mammals		
Blue whale	*Balaenoptera musculus*	E
Sei whale	*Balaenoptera borealis*	E
Sperm whale	*Physeter macrocephalus*	E
Fin whale	*Balaenoptera physalus*	E
Sea Turtles		
Green sea turtle	*Chelonia mydas*	E/T[3]
Hawksbill sea turtle	*Eretmochelys imbricata*	E
Kemp's ridley sea turtle	*Lepidochelys kempii*	E
Leatherback sea turtle	*Dermochelys coriacea*	E
Loggerhead sea turtle	*Caretta caretta*	T
Invertebrates		
Elkhorn coral	*Acropora palmata*	T
Staghorn coral	*Acropora cervicornis*	T
Fish		
Smalltooth sawfish	*Pristis pectinata*	E[4]

[3] Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered.
[4] The U.S. distinct population segment (DPS).

3.1 Analysis of Species Not Likely to be Adversely Affected

We have determined that the proposed action being considered in this opinion is not likely to adversely affect *Acropora* corals or endangered whales. The following discussion summarizes our rationale for this determination. These species are excluded from further analysis and consideration in this opinion.

Acropora spp.

Listed Acroporid corals are considered to be environmentally sensitive requiring relatively clear, well circulated water; optimal water temperatures are 25°-29°C. The environmental conditions of most of the Gulf of Mexico EEZ are not suitable for Acroporid corals. Elkhorn coral and staghorn coral may both occur near the Florida Keys in waters less than 30 m. Only approximately 645 km^2 (249 mi^2) of Gulf of Mexico EEZ waters in this area are within the potential depth range of these species. Outside of this small area, only a single colony of elkhorn coral has been observed in the Flower Garden Banks in the northwestern Gulf of Mexico and this area is protected. Amendment 1 to the RFFMP established the Longline/Buoy Gear Area Closure, which is a permanent closure to use of these gears for reef fish harvest inshore of 20 fathoms off the Florida shelf and inshore of 50 fathoms for the remainder of the Gulf. The Tortugas North and South Marine Reserves are no-take areas cooperatively implemented by the state of Florida, National Ocean Survey, the Council, and the National Park Service and were established through Amendment 19. In addition, Generic Amendment 3 for Addressing Essential Fish Habitat Requirements, Habitat Areas of Particular Concern, and Adverse Effects of Fishing prohibited the use of anchors in these marine reserves. Generic Amendment 3 also prohibits bottom anchoring, and the use of trawling gear, bottom longlines, buoy gear, and all traps/pots on coral reefs are prohibited in the East and West Flower Garden Banks. Given the rarity of listed *Acropora spp*. in the proposed action area and the protective regulations in place where *Acropora* are most likely to occur, adverse effects are extremely unlikely and discountable.

Endangered whales

Endangered whales are not likely to be adversely affected by the continued authorization of the Gulf reef fish fishery because they are extremely unlikely to overlap geographically with areas fished. Sperm whales are the most abundant large cetacean in the Gulf of Mexico, found year-round in waters greater than 200 m (Hansen et al. 1996, Davis et al. 2002, Mullin and Fulling 2003). In contrast, reef fishing generally occurs in waters less than 200 m. Sei and blue whales also typically occur in deeper waters and neither is commonly observed in the waters of the Gulf of Mexico. Fin whales are generally found along the 100-meter isobath with sightings also spread over deeper water including canyons along the shelf break. Additionally, there are no documented interactions between large whales and reef fish gear. Therefore, we believe any adverse affects to ESA-listed marine mammals are extremely unlikely to occur and discountable.

3.2 Analysis of Species Likely to be Adversely Affected

Green, hawksbill, Kemp’s ridley, leatherback, and loggerhead sea turtles and the smalltooth sawfish are all likely to be adversely affected by the proposed action. Green, hawksbill, Kemp’s ridley, leatherback, and loggerhead sea turtles area all highly migratory and travel widely throughout the Gulf and are known to occur in areas subject to considerable reef fish fishing activity. Smalltooth sawfish are also known to occur in the Gulf where fishing activity occurs, but mainly only off peninsular Florida. All of these species have either been documented as taken incidentally in reef fish gear or are vulnerable to one or more of the gear types used, based on their capture in other southeast fisheries using similar gear. The remaining sections of this opinion will focus solely on these species.

The following subsections are synopses of the best available information on the life history, distribution, population trends, and current status of the five species of sea turtles that are likely to be adversely affected by one or more components of the proposed action. Additional background information on the status of sea turtle species can be found in a number of published documents, including: recovery plans for the Atlantic green sea turtle (NMFS and USFWS 1991a), hawksbill sea turtle (NMFS and USFWS 1993), Kemp's ridley sea turtle (USFWS and NMFS 1992), leatherback sea turtle (NMFS and USFWS 1992), and loggerhead sea turtle (NMFS and USFWS 2008); Pacific sea turtle recovery plans (NMFS and USFWS, 1998a-d); and sea turtle status reviews, stock assessments, and biological reports (NMFS and USFWS 1995, NMFS and USFWS 2007a-e, Marine Turtle Expert Working Group (TEWG) 1998, 2000, 2007, and 2009; NMFS SEFSC 2001 and 2009d, and Conant et al. 2009). Sources of background information on the smalltooth sawfish include the smalltooth sawfish status review (NMFS 2000), the proposed and final listing rules, and pertinent other publications (e.g., Simpfendorfer 2001, Seitz and Poulakis 2002, Simpfendorfer and Wiley 2004 and 2005, Poulakis and Seitz 2004).

3.2.1 Green Sea Turtle

Green turtles are distributed circumglobally, and can be found in the Pacific, Indian, and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991a, Seminoff 2004, NMFS and USFWS 2007a). In 1978, the Atlantic population of the green sea turtle was listed as threatened under the ESA, except for the breeding populations in Florida and on the Pacific coast of Mexico, which were listed as endangered.

3.2.1.1 Pacific Ocean

Green turtles occur in the eastern, central, and western Pacific. Foraging areas are also found throughout the Pacific and along the southwestern U.S. coast (NMFS and USFWS 1998a). Nesting is known to occur in the Hawaiian archipelago, American Samoa, Guam, and various other sites in the Pacific. The only major population (>2,000 nesting females) of green turtles in the western Pacific occurs in Australia and Malaysia, with smaller colonies throughout the area. Green turtles have generally been thought to be declining throughout the Pacific Ocean, with the exception of Hawaii, from a combination of overexploitation and habitat loss (Seminoff 2002). Indonesia has a widespread distribution of green turtles, but has experienced large declines over the past 50 years. Historically, green turtles were used in many areas of the Pacific for food. They were also commercially exploited and this, coupled with habitat degradation, led to their decline in the Pacific (NMFS and USFWS 1998a). Green turtles in the Pacific continue to be affected by poaching, habitat loss or degradation, fishing gear interactions, and fibropapillomatosis (NMFS and USFWS 1998a, NMFS 2004a).

Hawaiian 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 2003). The East Island nesting beach in Hawaii is showing a 5.7 percent annual growth rate over 25 plus years (Chaloupka et al. 2007). In the Eastern Pacific, mitochondrial DNA analysis has indicated that there are three key nesting populations: Michoacán, Mexico; Galapagos Islands, Ecuador; and Islas Revillagigedos, Mexico (Dutton 2003). The number of nesting females per year exceeds 1,000 females at each site (NMFS and USFWS 2007a). However, historically, greater than 20,000 females per year are believed to have nested in Michoacán alone (Cliffton et al. 1982, NMFS and USFWS 2007a). Thus, the current number of nesting females is still far below what has historically occurred. There is also sporadic green turtle nesting along the Pacific coast of Costa Rica. However, at least a few of the non-Hawaiian nesting stocks in the Pacific have recently been found to be undergoing long-term increases. Data sets over 25 years in Chichi-jima, Japan; Heron Island, Australia; and Raine Island, Australia show increases (Chaloupka et al. 2007). These increases are thought to be the direct result of long-term conservation measures.

3.2.1.2 Indian Ocean

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

3.2.1.3 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 seagrasses. This includes areas near mainland coastlines, islands, reefs, or shelves, as well as 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

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 Lagoon 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 Caribbean coast of Panama, the Miskito Coast in Nicaragua, and scattered areas along Colombia and Brazil (Hirth 1997). 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).

The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Meylan et al. 1995, Johnson and Ehrhart 1994). 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). Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The 5-year status review for the species identified eight geographic areas considered to be primary sites for green sea turtle nesting in the Atlantic/Caribbean and reviewed the trend in nest count data for each (NMFS and USFWS 2007a). These include: (1) Yucatán Peninsula, Mexico; (2) Tortuguero, Costa Rica; (3) Aves Island, Venezuela; (4) Galibi Reserve, Suriname; (5) Isla Trindade, Brazil; (6) Ascension Island, United Kingdom; (7) Bioko Island, Equatorial Guinea; and (8) Bijagos Achipelago (Guinea-Bissau) (NMFS and USFWS 2007a). Nesting at all of these sites was considered to be stable or increasing with the exception of Bioko Island and the Bijagos Archipelago where the lack of sufficient data precluded a meaningful trend assessment for either site (NMFS and USFWS 2007a). Seminoff (2004) likewise reviewed green sea turtle nesting data for eight sites in the western, eastern, and central Atlantic, including all of the above with the exception that nesting in Florida was reviewed in place of Isla Trindade, Brazil. Seminoff (2004) concluded that all sites in the central and western Atlantic showed increased nesting with the exception of nesting at Aves Island, Venezuela, while both sites in the eastern Atlantic demonstrated decreased nesting. These sites are not inclusive of all green sea turtle nesting in the Atlantic. However, other sites are not believed to support nesting levels high enough that would change the overall status of the species in the Atlantic (NMFS and USFWS 2007a).

By far, the most important nesting concentration for green turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007a). Nesting in the area has increased considerably since the 1970s, and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007a). The number of females nesting per year on beaches in the Yucatán, Aves Island, Galibi Reserve, and Isla Trindade number in the hundreds to low thousands, depending on the site (NMFS and USFWS 2007a). In the United States, certain Florida nesting beaches have been designated index beaches. Index beaches were established to standardize data collection methods and effort on key nesting beaches. The pattern of green turtle nesting shows biennial peaks in abundance with a generally positive trend during the ten years of regular monitoring since establishment of the index beaches in 1989, perhaps due to increased protective legislation throughout the Caribbean (Meylan et al. 1995). An average of 5,039 green turtle nests were laid annually in Florida between 2001 and 2006, with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a). Data from the index nesting beaches program in Florida support the dramatic increase in nesting. In 2007, there were 9,455 green turtle nests found just on index nesting beaches, the highest since index beach monitoring began in 1989. The number fell back to 6,385 in 2008, but that is thought to be part of the normal biennial nesting cycle for green turtles (FWC Index Nesting Beach Survey Database). Occasional nesting has been documented along the Gulf coast of Florida, at southwest Florida beaches, as well as the beaches on the Florida Panhandle (Meylan et al. 1995). More recently, green turtle nesting occurred on Bald Head Island, North Carolina; just east of the mouth of the Cape Fear River; on Onslow Island; and on Cape Hatteras National Seashore. Increased nesting has also been observed along the Atlantic coast of Florida, on beaches where only loggerhead nesting was observed in the past (Pritchard 1997). Recent modeling by Chaloupka et al. (2007) using data sets of 25 years or more has resulted in an estimate of the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9 percent, and the Tortuguero, Costa Rica, population growing at 4.9 percent annually.

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). Ehrhart et al. (2007) has also documented a significant increase in in-water abundance of green turtles in the Indian River Lagoon area. 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.

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation 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).

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities, i.e., global warming. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency's climate change Web page provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty.

The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts may have significant impacts to the hatchling sex ratios of green turtles (NMFS and USFWS 2007a). In marine turtles, sex is determined by temperature in the middle third of incubation, with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25º-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007a). Green sea turtle hatchling size also appears to be influenced by incubation temperatures, with smaller hatchlings produced at higher temperatures (Glenn et al. 2003).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction has denuded vegetation. Sea level rise from global climate change (IPCC 2007) is also a potential problem, particularly for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increased frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, forage fish, etc., which could ultimately affect the primary foraging areas of green sea turtles.

3.2.1.4 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 anthropogenic threats 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. The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the almost 20 years of regular monitoring since establishment of index beaches in Florida in 1989.

3.2.2 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 sea turtle species, ranging from approximately 30°N latitude to 30°S latitude. They are closely associated with coral reefs and other hardbottom habitats, but they are also found in other habitats including inlets, bays, and coastal lagoons (NMFS and USFWS 1993). There are only five remaining 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 percent during the last three generations (105 years) (Meylan and Donnelly 1999).

3.2.2.1 Indian Ocean

Approximately 83 nesting rookeries have been identified for hawksbill sea turtles, 31 occur in the Indian Ocean. Many of those nesting areas are relatively small hosting 100 or fewer nesting females annually. However, some nesting rookeries in Madagascar, Iran, and Western Australia may have as many as 1,000 to 2,000 nesting females annually. Based on the number of nesting females the population trends at the 31 nesting rookeries over the recent past (last 20 years) have remained stable in 2 locations, declined at 5, and are unknown for 24. Historically (20 to 100 years ago), populations trends at these nesting rookeries have been in decline at 17 sites and are unknown for 14 (NMFS and USFWS 2007b).

3.2.2.2 Pacific Ocean

Anecdotal reports throughout the Pacific indicate the current Pacific hawksbill population is well below historical levels (NMFS 2004a). 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 2004a). 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 2004a). However, along the eastern Pacific Rim where nesting was common in the 1930s, hawksbills are now rare or absent (Cliffton et al. 1982, NMFS 2004a).

3.2.2.3 Atlantic Ocean

In the western Atlantic, the largest hawksbill nesting population occurs on the Yucatán Peninsula of Mexico (Garduño-Andrade et al. 1999). With respect to the United States, nesting occurs in Puerto Rico, the U.S. Virgin Islands, and along the southeast coast of Florida. Nesting also occurs outside of the United States and its territories, in Antigua, Barbados, Costa Rica, Cuba, and Jamaica (Meylan 1999a). Outside of the nesting areas, hawksbills have been seen off the U.S. Gulf of Mexico states and along the Eastern Seaboard as far north as Massachusetts, although sightings north of Florida are rare (NMFS and USFWS 1993).

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). 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 their 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 sea 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 juveniles 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 Díez 1998).

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

Population Dynamics and Status

Nesting within the southeastern United States 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 with other sea turtle species, hawksbill sea turtles are affected by habitat loss, habitat degradation, marine pollution, marine debris, fishery interactions, and poaching in some parts of their range. A complete list of other indirect factors can be found in NMFS SEFSC (2001).

There continues to be a black market for hawksbill shell products ("tortoiseshell"), which likely contributes to the harvest of this species.

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities, i.e., global warming. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency's climate change Web page provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty.

The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts may impact the hatchling sex ratios of hawksbill sea turtles (NMFS and USFWS 2007b). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25º-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward a higher numbers of females (NMFS and USFWS 2007b).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction has denuded vegetation. Sea level rise from global climate change (IPCC 2007) is also a potential problem, particularly for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increased frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, coral reefs, forage fish, etc. Since hawksbills are typically associated with coral reef ecosystems, increases in global temperatures leading to coral death (Sheppard 2006) could adversely affect the foraging habitats of this species.

3.2.2.4 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.

3.2.3 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's Tamaulipas State. This 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.

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-hatchling stage (pelagic stage) within the Gulf of Mexico. 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 Eastern 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). A 2005 dietary study of immature Kemp's ridleys off southwest Florida documented predation on benthic tunicates, a previously undocumented food source for this species (Witzell and Schmid 2005). These 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). The number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3 percent per year from 1985 to 1999 (TEWG 2000). These trends are further

supported by 2004-2007 nesting data from Mexico. The number of nests over that period has increased from 7,147 in 2004, to 10,099 in 2005, to 12,143 in 2006, and 15,032 during the 2007 nesting season (Gladys Porter Zoo 2007). An unofficial estimate for 2008 stands at 17,882 nests (S. Epperly, NMFS, SEFSC, pers. comm.). A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 128 in 2007, and a record 195 in 2008 (National Park Service data).

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 TEDs in the United States' and Mexico's 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. Recent calculations of nesting females determined from nest counts show that the population trend is increasing towards that recovery goal, with an estimate of 4,047 nesters in 2006 and 5,500 in 2007 (NMFS and USFWS 2007c, Gladys Porter Zoo 2007).

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 sea 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* spp., and *Cancer* spp. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). Upon leaving Chesapeake Bay in autumn, juvenile Kemp's ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined there by juveniles of the same size from North Carolina sounds and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Musick and Limpus 1997, Epperly et al. 1995a, Epperly et al. 1995b).

Threats

Kemp's ridleys face many of the same threats as other sea turtle species, 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 sea turtles were found on Cape Cod beaches (R. Prescott, NMFS, pers. comm. 2001). Annual cold-stunning events do not always occur at this magnitude; the extent of episodic major cold-stun events may be associated with numbers of sea turtles utilizing Northeast waters in a given year, oceanographic conditions, and the occurrence of storm events in the late fall. Many cold-stunned sea turtles can survive if found early enough, but cold-stunning events can still represent a significant cause of natural mortality. A complete list of other indirect factors can be found in NMFS SEFSC (2001).

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 in previous sections. For example, in the spring of 2000, a total of 5 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 sea 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 5 Kemp's ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction because it is unlikely that all of the carcasses washed ashore.

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities, i.e., global warming. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency's climate change Web page provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty.

The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts may be significant to the hatchling sex ratios of Kemp's ridley sea turtles (Wibbels 2003, NMFS and USFWS 2007c). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25º-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward a higher numbers of females (NMFS and USFWS 2007c).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction has denuded vegetation. Sea level rise from global climate change (IPCC 2007) is also a potential problem, particularly for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increased frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, forage fish, etc., which could ultimately affect the primary foraging areas of Kemp's ridley sea turtles.

3.2.3.1 Summary of Kemp's Ridley Status

The only major nesting site for Kemp's 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 from 1985 to 2008. Nesting has also exceeded 12,000 nests per year from 2004-2008 (Gladys Porter Zoo database). 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 has allowed the species to begin to recover. 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.

3.2.4 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 (Ernst and Barbour 1972). Leatherback sea turtles are the largest living turtles and range farther than any other sea turtle species. The large size of adult leatherbacks and their tolerance to 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 71ºN to 47ºS 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, the 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 they 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, the most recent population estimate for leatherback sea turtles from just the North Atlantic breeding groups is a range of 34,000-90,000 adult individuals (20,000-56,000 adult females) (TEWG 2007).

3.2.4.1 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, Suárez 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 (Suárez 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., Suárez 1999).

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

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 1998-1999 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, and 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 8-17 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 subadult 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). The NMFS 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 (e.g., Irian Jaya) (NMFS 2004a).

3.2.4.2 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). Previous genetic analyses of leatherbacks using only mitochondrial DNA (mtDNA) resulted in an earlier determination that within the Atlantic basin there are at least three 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). Further genetic analyses using microsatellite markers in nuclear DNA along with the mtDNA data and tagging data has resulted in Atlantic Ocean leatherbacks now being divided into seven groups or breeding populations: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG 2007). 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 well over 30 years. It has been thought that 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). However, some recent research using sophisticated methods of analyzing leatherback ossicles has cast doubt on the previously accepted age to maturity figures, with leatherbacks in the western North Atlantic possibly not reaching sexual maturity until as late as 29 years of age (Avens and Goshe 2007). Continued research in this area is vitally important to understanding the life history of leatherbacks and has important implications in management of the species.

Female leatherbacks nest frequently (up to 10 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 percent) 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 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 26ºC until they exceed 100 ccl.

Although leatherbacks are the most pelagic of the sea turtles, they enter coastal waters on an irregular 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 to 4,151 m, but 84.4 percent 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 7ºC to 27.2ºC (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.

General differences in migration patterns and foraging grounds may occur between the seven nesting assemblages, but data is limited. Per TEWG (2007):

> Marked or satellite tracked turtles from the Florida and North Caribbean assemblages have been re-sighted off North America, in the Gulf of Mexico and along the Atlantic coast and a few have moved to western Africa, north of the equator. In contrast, Western Caribbean and Southern Caribbean/Guianas animals have been found more commonly in the eastern Atlantic, off Europe and northern Africa, as well as along the North American coast. There are no reports of marked animals from the Western North Atlantic assemblages entering the Mediterranean Sea or the South Atlantic Ocean, though in the case of the Mediterranean this may be due more to a lack of data rather than failure of Western North Atlantic turtles moving into the Sea. The tagging data coupled with the satellite telemetry data indicate that animals from the western North Atlantic nesting subpopulations use virtually the entire North Atlantic Ocean. In the South Atlantic Ocean, tracking and tag return data follow three primary patterns. Although telemetry data from the West African nesting assemblage showed that all but one remained on the shallow continental shelf, there clearly is movement to foraging areas of the south coast of Brazil and Argentina. There is also a small nesting aggregation of leatherbacks in Brazil, and while data are limited to a few satellite tracks, these turtles seem to remain in the southwest Atlantic foraging along the continental shelf margin as far south as Argentina.

South African nesting turtles apparently forage primarily south, around the tip of the continent.

Population Dynamics and Status

The status of the Atlantic leatherback population has been less clear than the Pacific population. This uncertainty has been a result of inconsistent beach and aerial surveys, cycles of erosion and reformation of nesting beaches in the Guianas (representing the largest nesting area), a lesser degree of nest-site fidelity than occurs with the hardshell sea turtle species, and inconsistencies in the availability and analyses of data. However, recent coordinated efforts at data collection and analyses by the Leatherback Turtle Expert Working Group have helped to clarify the understanding of the Atlantic population status (TEWG 2007).

The Southern Caribbean/Guianas stock is the largest known Atlantic leatherback nesting aggregation (TEWG 2007). This area includes the Guianas (Guyana, Suriname, and French Guiana), Trinidad, Dominica, and Venezuela, with the vast majority of the nesting occurring in the Guianas and Trinidad. Past analyses had shown that the nesting aggregation in French Guiana had been declining at about 15 percent per year since 1987 (NMFS SEFSC 2001). However, from 1979-1986, the number of nests was increasing at about 15 percent annually, which could mean that the current decline could be part of a nesting cycle that coincides with the erosion cycle of Guiana beaches described by Schultz (1975). It is thought that the cycle of erosion and reformation of beaches has resulted in shifting nesting beaches throughout this region. This was supported by the increased nesting seen in Suriname, where leatherback nest numbers have shown large recent increases concurrent with declines elsewhere (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 was thought to possibly show an increase (Girondot 2002 in Hilterman and Goverse 2003). In the past many sea turtle scientists have agreed 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 et al. 2001). Genetics studies have added support to this notion and have resulted in the designation of the Southern Caribbean/Guianas stock. Using both Bayesian modeling and regression analyses, the TEWG (2007) determined that the Southern Caribbean/Guianas stock had demonstrated a long-term, positive population growth rate (using nesting females as a proxy for population). This positive growth was seen within major nesting areas for the stock, including Trinidad, Guyana, and the combined beaches of Suriname and French Guiana (TEWG 2007).

The Western Caribbean stock includes nesting beaches from Honduras to Colombia. The most intense nesting in that area occurs in Costa Rica, Panama, and the Gulf of Uraba in Colombia (Duque et al. 2000). The Caribbean coast of Costa Rica and extending through Chiriquí Beach, Panama, represents the fourth largest known leatherback rookery in the world (Troëng et al. 2004). Examination of data from three index nesting beaches in the region (Tortuguero, Gandoca, and Pacuare in Costa Rica) using various Bayesian and regression analyses indicated that the nesting population likely was not growing over the 1995-2005 time series of available data (TEWG 2007), though modeling of the nesting data for Tortuguero indicates a possible 67.8 percent decline between 1995 and 2006 (Troëng et al. 2007).

Nesting data for the Northern Caribbean stock is available from Puerto Rico, the U.S. Virgin Islands (St. Croix), and the British Virgin Islands (Tortola). In Puerto Rico, the primary nesting beaches are at Fajardo and on the island of Culebra. Nesting between 1978 and 2005 has ranged between 469-882 nests, and the population has been growing since 1978, with an overall annual growth rate of 1.1 percent (TEWG 2007). At the primary nesting beach on St. Croix, the Sandy Point National Wildlife Refuge, nesting has fluctuated from a few hundred nests to a high of 1,008 in 2001, and the average annual growth rate has been approximately 1.1 percent from 1986-2004 (TEWG 2007). Nesting in Tortola is limited, but has been increasing from 0-6 nests per year in the late 1980s to 35-65 per year in the 2000s, with an annual growth rate of approximately 1.2 percent between 1994 and 2004 (TEWG 2007).

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800-900 per year in the 2000s following nesting totals fewer than 100 nests per year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the index nesting beach surveys, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17 percent between 1989 and 2005. In 2007, a record 517 leatherback nests were observed on the index beaches in Florida, with 265 in 2008 (FWC Index Nesting Beach database). The reduction in nesting from 2007 to 2008 is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting.

The West African nesting stock of leatherbacks is a large, important, but mostly unstudied aggregation. Nesting occurs in various countries along Africa's Atlantic coast, but much of the nesting is undocumented and the data are inconsistent. However, it is known that Gabon has a very large amount of leatherback nesting, with at least 30,000 nests laid along its coast in one season (Fretey et al. in press). Fretey et al. (in press) also provide detailed information about other known nesting beaches and survey efforts along the Atlantic African coast. Because of the lack of consistent effort and minimal available data, trend analyses were not possible for this stock (TEWG 2007).

Two other small but growing nesting stocks utilize the beaches of Brazil and South Africa. For the Brazilian stock, the TEWG (2007) analyzed the available data and determined that between 1988 and 2003 there was a positive annual average growth rate of 1.07 percent using regression analyses and 1.08 percent using Bayesian modeling. The South African stock has an annual average growth rate of 1.06 based on regression modeling and 1.04 percent using the Bayesian approach (TEWG 2007).

Estimates of total population size for Atlantic leatherbacks are difficult make due to the inconsistent nature of the available nesting data. 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. Spotila et al. (1996) estimated that the leatherback population for the entire 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. This is consistent with the estimate of 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) determined by the TEWG (2007).

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 sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), 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 their attraction 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 typically foul-hooked by longline gear (e.g., on the flipper or shoulder area) rather than getting mouth-hooked or swallowing the hook (NMFS SEFSC 2001). A total of 24 nations, including the United States (accounting for 5-8 percent of the hooks fished), have fleets participating in pelagic longline fisheries in the area. 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). Genetic studies performed within the Northeast Distant Fishery Experiment indicate that the leatherbacks captured in the Atlantic highly migratory species pelagic longline fishery were primarily from the French Guiana and Trinidad nesting stocks (over 95 percent); individuals from West African stocks were surprisingly absent (Roden et al. in press).

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 in NMFS SEFSC 2001). 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 NMFS SEFSC 2001). 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 in NMFS SEFSC

2001). 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 (NMFS 2002b), 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. Leatherbacks also interact with the Gulf of Mexico shrimp fishery. For many years, TEDs required for use in these fisheries were less effective at excluding leatherbacks than the smaller, hard-shelled turtle species. To address this problem, on February 21, 2003, the NMFS 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 (NEFSC) observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off 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 percent.

Poaching is not known to be a problem for nesting populations in the continental United States. However, in 2001 the NMFS SEFSC noted that poaching of juveniles and adults was 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 percent of the 16 cases examined) contained plastic (Mrosovsky 1981). Along the coast of Peru, intestinal contents of 19 of 140 (13 percent) 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 might 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 of 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 (Lageux 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-M. 2000). A study by the Trinidad and Tobago's Institute for Marine Affairs (IMA) in 2002 confirmed that bycatch of leatherbacks is high in Trinidad. IMA estimated that more than 3,000 leatherbacks were captured incidental to gillnet fishing in the coastal waters of Trinidad in 2000. As much as one-half or more of the gravid turtles in Trinidad and Tobago waters may be killed (Lee Lum 2003). 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).

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities, i.e., global warming. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency's climate change Web page provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty. Leatherback sea turtles, however, are speculated to be the most capable of coping with climate change because they have the widest geographical distribution of any sea turtle and show relatively weak beach nesting site fidelity (Dutton et al. 1999).

The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts may alter the hatchling sex ratios of leatherback sea turtles (Mrosovsky et al. 1984, Hawkes et al 2007, NMFS and USFWS 2007d). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25º-35°C (Ackerman 1997). However, unlike other sea turtles species, leatherbacks tend to select nest locations in the cooler tidal zone of beaches (Kamel and Mrosovsky 2003). This preference may help mitigate the effects from increased beach temperature (Kamel and Mrosovsky 2003).

Sea level rise from global climate change (IPCC 2007) is also a potential problem, particularly for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Global climate change is likely to influence the distribution and abundance of jellyfish, the primary prey item of leatherbacks (NMFS and USFWS 2007d). Several studies have shown leatherback distribution is influenced by jellyfish abundance (e.g., Houghton et al. 2006, Witt et al. 2006, Witt et al. 2007). How these changes in jellyfish abundance and distribution will impact leatherback sea turtle foraging behavior and distribution is currently unclear (Witt et al. 2007).

3.2.4.3 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 somewhat more confounded, although the overall trend appears to be stable to increasing. The data indicate increasing or stable nesting populations in all of the regions except West Africa (no long-term data are available) and the Western Caribbean (TEWG 2007). Some of the same factors that led to precipitous declines of leatherbacks in the Pacific also affect leatherbacks in the Atlantic (i.e., leatherbacks are captured and killed in many kinds of fishing gear and interact with fisheries in state, federal, and international waters). Poaching is also a problem that affects leatherbacks occurring in U.S. waters. Leatherbacks are also more susceptible to death or injury from ingesting marine debris than other turtle species.

3.2.5 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, Pacific, and Indian Oceans. The majority of loggerhead nesting occurs in the Western Atlantic Ocean (South Florida, United States), and the western Indian Ocean (Masirah, Oman); in both locations nesting assemblages have more than 10,000 females nesting each year (NMFS and USFWS 2008). Loggerhead sea turtles are the most abundant species of sea turtle in U.S. waters.

3.2.5.1 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 sea turtles (Bolten et al. 1996). More recent information suggests that nest numbers have increased somewhat over the period 1998-2004 (NMFS and USFWS 2007e). However, this time period is too short to make a determination of the overall trend in nesting (NMFS and USFWS 2007e). 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 have 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 Australia, where turtles are taken in bottom trawl and longline fisheries, efforts have been made to reduce fishery bycatch (NMFS and USFWS 2007e). In addition, the abundance of loggerhead sea turtles in 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).

In July 2007, NMFS received a petition requesting that loggerhead sea turtles in the North Pacific be classified as a distinct population segment (DPS) with endangered status and critical habitat designated. The petition also requested that if the North Pacific loggerhead is not determined to meet the DPS criteria that loggerheads throughout the Pacific Ocean be designated as a DPS and listed as endangered. A thorough review by the Loggerhead Turtle Biological Review Team determined that Pacific loggerheads can be divided into two DPSs, the North Pacific DPS and South Pacific DPS (Conant et al. 2009).

3.2.5.2 Indian Ocean

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

In the southwestern Indian Ocean, loggerhead nesting has shown signs of recovery in South Africa where protection measures have been in place for decades. However, in other southwestern areas (e.g., Madagascar and Mozambique) loggerhead nesting groups are still affected by subsistence hunting of adults and eggs (Baldwin et al. 2003). The largest known nesting group of loggerheads in the world occurs in Oman in the Northern Indian Ocean. An estimated 20,000-40,000 females nest each year at Masirah, the largest nesting site within Oman (Baldwin et al. 2003). In the Eastern Indian Ocean, all known nesting sites are found in Western Australia (Dodd 1988). As has been found in other areas, nesting numbers are disproportionate within the area, with the majority of nesting occurring at a single location. This may, however, be the result of fox predation on eggs at other Western Australia nesting sites (Baldwin et al. 2003). The Loggerhead Turtle Biological Review Team determined that Indian Ocean loggerheads can be divided into three DPSs, the North Indian Ocean DPS, Southeast Indo-Pacific Ocean DPS, and Southwest Indian Ocean DPS (Conant et al. 2009).

3.2.5.3 Mediterranean Sea

Nesting in the Mediterranean is confined almost exclusively to the eastern basin. The highest level of nesting in the Mediterranean occurs in Greece, with an average of 3,050 nests per year. There is a long history of exploitation of loggerheads in the Mediterranean. Although much of this is now prohibited, some directed take still occurs. Loggerheads in the Mediterranean also face the threat of habitat degradation, incidental fishery interactions, vessel strikes, and marine pollution (Margaritoulis et al. 2003). Longline fisheries, in particular, are believed to catch thousands of juvenile loggerheads each year (NMFS and USFWS 2007e), although genetic analyses indicate that only a portion of the loggerheads captured originate from nesting groups in the Mediterranean (Laurent et al. 1998). The Loggerhead Turtle Biological Review Team determined that Mediterranean loggerheads could comprise a separate DPS, denoted the Mediterranean Sea DPS (Conant et al. 2009).

3.2.5.4 Atlantic Ocean

In the Western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. Previous section 7 analyses have recognized at least five Western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to Northeast Florida at about 29ºN; (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 recently published recovery plan for the Northwest Atlantic population of loggerhead sea turtles concluded, based on recent advances in genetic analyses, that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula and that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are: (1) the Northern Recovery Unit (Florida/Georgia border north through southern Virginia); (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida); (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida); (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas); and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 2008). The recovery plan concluded that all recovery units are essential to the recovery of the species. The Loggerhead Biological Review Team determined that loggerhead turtles in the Atlantic meet the required characteristics to be separated into three DPSs, the Northwest Atlantic DPS, Northeast Atlantic DPS, and South Atlantic DPS (Conant et al. 2009).

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. Recent estimates are slightly higher. Estimated ages of maturity range from 23-42 years, with a nominal value of 30 years, and the benthic immature stage lasts from 13-24 years (TEWG 2009, NMFS SEFSC 2009d).

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 per 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 that have entered the benthic environment undertake routine migrations along the coast that are limited by seasonal water temperatures. Loggerhead sea turtles occur year-round in offshore waters off 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. 1995a-c), 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 of loggerheads 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 Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles ($\geq$ 11°C) (Epperly et al. 1995a-c). 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 dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hardbottom habitats.

More recent studies are revealing that the loggerhead's life history is more complex than previously believed. Rather than making discrete developmental shifts from oceanic to neritic environments, research is showing that both adults and (presumed) neritic stage juveniles continue to use the oceanic environment and will move back and forth between the two habitats (Witzell 2002, Blumenthal et al. 2006, Hawkes et al. 2006, McClellan and Read 2007). One of the studies tracked the movements of adult females post-nesting and found a difference in habitat use was related to body size, with larger turtles staying in coastal waters and smaller turtles traveling to oceanic waters (Hawkes et al. 2006). A tracking study of large juveniles found that the habitat preferences of this life stage were also diverse, with some remaining in neritic waters while others moved off into oceanic waters (McClellan and Read 2007). However, unlike the Hawkes et al. study (2006), there was no significant difference in the body size of turtles that remained in neritic waters versus oceanic waters (McClellan and Read 2007). In either case, the research not only supports the need to revise the life history model for loggerheads but also demonstrates that threats to loggerheads in both the neritic and oceanic environments are likely impacting multiple life stages of this species.

Population Dynamics and Status

A number of stock assessments and similar reviews (TEWG 1998, TEWG 2000, NMFS SEFSC 2001 and 2009d, Heppell et al. 2003, NMFS and USFWS 2008, Conant et al. 2009, TEWG 2009) have examined the stock status of loggerheads in the Atlantic Ocean, but none have been able to develop a reliable estimate of absolute population size.

Numbers of nests and nesting females can vary widely from year to year. However, nesting beach surveys can provide a reliable assessment of trends in the adult female population, due to the strong nest site fidelity of females turtles, as long as such studies are sufficiently long and effort and methods are standardized (see, e.g., NMFS and USFWS 2008, Meylan 1982). NMFS and USFWS (2008) concluded that the lack of change in two important demographic parameters of loggerheads, remigration interval and clutch frequency, indicate that time series on numbers of nests can provide reliable information on trends in the female population. Recent analysis of available data for the Peninsular Florida Recovery Unit has led to the conclusion that the observed decline in nesting for that unit over the last several years can best be explained by an actual decline in the number of adult female loggerheads in the population (Witherington et al. 2009).

Annual nest totals from beaches within what NMFS and USFWS have defined as the Northern Recovery Unit (NRU) averaged 5,215 nests from 1989-2008, a period of near-complete surveys of NRU nesting beaches (GDNR unpublished data, NCWRC unpublished data, SCDNR unpublished data), representing approximately 1,272 nesting females per year (4.1 nests per female, Murphy and Hopkins 1984). The loggerhead nesting trend from daily beach surveys showed a significant decline of 1.3 percent annually. Nest totals from aerial surveys conducted by SCDNR showed a 1.9 percent annual decline in nesting in South Carolina since 1980. Overall, there is strong statistical data to suggest the NRU has experienced a long-term decline. Data in 2008 has shown improved nesting numbers, but future nesting years will need to be analyzed to determine if a change in trend is occurring. In 2008, 841 loggerhead nests were observed compared to the 10-year average of 715 nests in North Carolina. In South Carolina, 2008 was the seventh highest nesting year on record since 1980, with 4,500 nests, but this did not change the long-term trend line indicating a decline on South Carolina beaches. Georgia beach surveys located a total of 1,648 nests in 2008. This number surpassed the previous statewide record of 1,504 nests in 2003. According to analyses by Georgia DNR, the 40-year time-series trend data show an overall decline in nesting, but the shorter comprehensive survey data (20 years) indicate a stable population (SCDNR 2008, GDNR unpublished data, NCWRC unpublished data, SCDNR unpublished data).

Another consideration that may add to the importance and vulnerability of the NRU is the sex ratios of this subpopulation. NMFS scientists have estimated that the Northern subpopulation produces 65 percent males (NMFS SEFSC 2001). However, research conducted over a limited time frame has found opposing sex ratios (Wyneken et al. 2004), 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 Peninsular Florida Recovery Unit (PFRU) is the largest loggerhead nesting assemblage in the Northwest Atlantic. A near-complete nest census undertaken from 1989 to 2007 showed a mean of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (from NMFS and USFWS 2008). An analysis of index nesting beach data shows a decline in nesting by the PFRU between 1989 and 2008 of 26 percent over the period, and a mean annual rate of decline of 1.6 percent (Witherington et al. 2009, NMFS and USFWS 2008). In 2008, nesting numbers increased significantly compared with the greatly depressed nesting seen in the previous years, returning to 2002 nesting levels. However, early 2009 nesting data appears to show that this does not signify a reversal in the negative trend. Projected nesting for 2009, based upon nesting counts for May and June, indicates a likely return to the low nesting numbers of recent years (B. Witherington Power Point presentation slide based upon FWRI loggerhead index nesting beach data 2009)

The remaining three recovery units—Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU)—are much smaller nesting assemblages but still considered essential to the continued existence of the Northwest Atlantic population. Nesting surveys for the DTRU are conducted as part of Florida's statewide survey program. Survey effort has been relatively stable during the 9-year period from 1995-2004 (although the 2002 year was missed). Nest counts ranged from 168-270, with a mean of 246, but with no detectable trend during this period (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide Nesting Beach Survey Data, NMFS and USFWS 2008). Nest counts for the NGMRU are focused on index beaches rather than all beaches where nesting occurs. The 12-year dataset (1997-2008) of index nesting beaches in the area shows a significant declining trend of 4.7 percent annually (NMFS and USFWS 2008). Similarly, nesting survey effort has been inconsistent among the GCRU nesting beaches and no trend can be determined for this subpopulation. 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. However, nesting has declined since 2001, and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008).

Determining the meaning of the nesting decline data is confounded by various in-water research that suggests the abundance of neritic juvenile loggerheads is steady or increasing (Ehrhart et al. 2007, M. Bresette pers. comm. regarding captures at the St. Lucie Power Plant, SCDNR unpublished SEAMAP-SA data, Epperly et al. 2007). Ehrhart et al. (2007) found no significant regression-line trend in the long-term dataset. However, notable increases in recent years and a statistically significant increase in CPUE of 102.4 percent from the 4-year period of 1982-1985 to the 2002-2005 periods were found. Epperly et al. (2007) determined the trends of increasing loggerhead catch rates from all the aforementioned studies in combination provide evidence there has been an increase in neritic juvenile loggerhead abundance in the southeastern United States in the recent past. A study led by the South Carolina Department of Natural Resources found that standardized trawl survey CPUE for loggerheads from South Carolina to North Florida was 1.5 times higher in summer 2008 than summer 2000. However, even though there were persistent inter-annual increases from 2000-2008, the difference was not statistically significant, likely due to the relatively short time series. Comparison to other data sets from the 1950s through 1990s showed much higher CPUEs in recent years regionally and in the South Atlantic Bight, leading SCDNR to conclude that it is highly improbable that CPUE increases of such magnitude could occur without a real and substantial increase in actual abundance (Arendt et al. 2009). Whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence is not clear. NMFS and USFWS (2008), citing Bjorndal et al. (2005), caution about extrapolating localized in-water trends to the broader population and relating localized trends in neritic sites to population trends at nesting beaches. The apparent overall increase in the abundance of neritic loggerheads in the southeastern U.S. may be due to increased abundance of the largest Stage III individuals (oceanic/neritic juveniles, historically referred to as small benthic juveniles), which could indicate a relatively large cohort that will recruit to maturity in the near future. However, such an increase in adults may be temporary, as in-water studies throughout the eastern U.S. also indicate a substantial decrease in the abundance of the smallest Stage III loggerheads, a pattern also corroborated by stranding data (TEWG 2009).

NMFS SEFSC has developed a stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS SEFSC 2009c and d). This model does not incorporate existing trends in the data (such as nesting trends) but instead relies on utilizing the available information on the relevant life-history parameters for sea turtles and then predicts future population trajectories based upon repeated model runs using those parameters, randomly sampling from within their distribution of values . Therefore, the model results do not build upon, but instead are complementary to, the trend data obtained through nest counts and other observations. The model uses the range of published information for the various parameters including mortality by stage, stage duration (years in a stage), and fecundity parameters such as eggs per nest, nests per nesting female, hatchling emergence success, sex ratio, and remigration interval. Model runs were done for each individual recovery unit as well as the western North Atlantic population as a whole, and the resulting trajectories were found to be very similar.

One of the SEFSC's most robust results was an estimate of the minimum adult female population size for the western North Atlantic in the 2004-2008 timeframe. NMFS SEFSC (2009d) estimated the minimum adult female population size to be likely between approximately 20,000 to 40,000 individuals, with a low likelihood of being up to 70,000. A much less robust estimate for total benthic females in the western North Atlantic was also obtained, with a likely range of approximately 60,000 to 700,000 individuals, up to less than 1 million (NMFS SEFSC 2009c).

The model results for population trajectory suggest that the population is most likely declining, but this result was very sensitive to the choice of the position of the parameters within their range and hypothesized distributions. Using the non-uniform distribution of parameter values, 14 percent of the runs resulted in growing populations, while 86 percent resulted in declining populations. While this does not translate to an equivalent statement that there is an 86 percent chance of a declining population, it does illustrate that given the life history parameter information currently thought to comprise the likely range of possibilities, it appears most likely that with no changes to those parameters the population will decline (NMFS SEFSC 2009c and d). Investigations of the model found that it was sensitive to changes in the parameter values. Changes to the mortality rates of benthic individuals alone (to evaluate potential effects of fishery bycatch reduction) found that relatively large changes in mortality were needed to change a substantial portion of the model outcomes. Additional model runs using the range of values for each life history parameter, the assumption of non-uniform distribution for those parameters, and a 5 percent natural (non-anthropogenic) mortality for the benthic stages resulted in a determination that a 60-70 percent reduction in anthropogenic mortality in the benthic stages would be needed to bring 50 percent of the model runs to a static (zero growth or decline) or increasing trajectory.

As a result of the large uncertainty in our knowledge of loggerhead life history, at this point predicting the future populations or population trajectories of loggerhead sea turtles with precision is very uncertain. Therefore, fine-scale examinations of how individual fisheries or actions impact the population trajectories cannot be resolved. The model results, however, are useful in guiding future research needs to better understand the life history parameters that have the most significant impact in the model. Additionally, the model results provide valuable insights into the likely overall declining status of the species and in the impacts of large-scale changes to various life history parameters (such as mortality rates for given stages) and how they may change the trajectories. The results of the model, in conjunction with analyses conducted on nest count trends (such as Witherington et al. 2009) which have suggested that the population decline is real, provide a strong basis for the conclusion that the western North Atlantic loggerhead population is in long-term decline. NMFS also convened a new Turtle Expert Working Group (TEWG) for loggerhead sea turtles to gather available data and examine the potential causes of the nesting decline and what the decline means in terms of population status. The TEWG ultimately could not determine whether or not decreasing annual numbers of nests among the Western North Atlantic loggerhead subpopulations were due to stochastic processes resulting in fewer nests, a decreasing average reproductive output of the adult females, decreasing numbers of adult females, or a combination of those factors. Past and present mortality factors that could impact current loggerhead nest numbers are many, and it is likely that several factors compound to create the current decline. TEWG (2009) found that regardless of the source of the decline, it is clear that the reduced nesting will result in depressed recruitment to subsequent life stages over the coming decades.

Threats

The 5-year status review of loggerhead sea turtles recently completed by NMFS and the USFWS provides a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and USFWS 2007e). The Loggerhead Recovery Team also undertook a comprehensive evaluation of threats to the species, and described them separately for the terrestrial, neritic, and oceanic zones (NMFS and USFWS 2008). The diversity of sea turtles' 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). Also, many nests were destroyed during the 2004 and 2005 hurricane seasons. Other sources of natural mortality include cold-stunning and biotoxin exposure.

Anthropogenic factors that impact hatchlings and adult female sea 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 increase in 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 (which may have a direct impact, or an indirect impact by causing harmful algal blooms), 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. Loggerheads in the pelagic environment are exposed to a series of longline fisheries, which include the highly migratory species' Atlantic pelagic longline fisheries, an Azorean longline fleet, a Spanish longline fleet, and various longline fleets in the Mediterranean Sea (Aguilar et al. 1995, Bolten et al. 1994, Crouse 1999b). Loggerheads in the benthic environment in waters off the coastal United States 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. The sizes and reproductive values of sea turtles taken by fisheries vary significantly, depending on the location and season of the fishery, and size-selectivity resulting from gear characteristics. Therefore, it is possible for fisheries that interact with fewer, more reproductively valuable turtles to have a greater detrimental effect on the population than one that takes greater numbers of less reproductively valuable turtles if the fishery removes a higher overall reproductive value from the population (Wallace et al. 2008). The Loggerhead Biological Review Team determined that the greatest threats to the Northwest Atlantic DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009). Attaining a more thorough understanding of the characteristics, as well as the quantity, of sea turtle bycatch across all fisheries is of great importance.

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities, i.e., global warming. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency’s climate change Web page provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty.

The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts may have significant impacts to the hatchling sex ratios of loggerhead sea turtles (NMFS and USFWS 2007e). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25º-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007e). Modeling suggests an increase of 2°C in air temperature would result in a sex ratio of over 80 percent female offspring for loggerheads nesting near Southport, North Carolina. The same increase in air temperatures at nesting beaches in Cape Canaveral, Florida, would result in close to 100 percent female offspring. More ominously, an air temperature increase of 3°C is likely to exceed the thermal threshold of most clutches, leading to death (Hawkes et al. 2007).

Warmer sea surface temperatures have been correlated to an earlier onset of loggerhead nesting in the spring (Weishampel et al. 2004, Hawkes et al. 2007), as well as short inter-nesting intervals (Hayes et al. 2002) and shorter nesting season (Pike et al. 2006).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction have denuded vegetation. Erosion control structures could potentially result in the permanent loss of nesting beach habitat or deter nesting females (NRC 1990). Alternatively, nesting females may nest on the seaward side of the erosion control structures, potentially exposing them to repeated tidal overwash (NMFS and USFWS 2007e). Sea level rise from global climate change (IPCC 2007) is also a potential problem, particularly for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish, etc., which could ultimately affect the primary foraging areas of loggerhead sea turtles.

Actions have been taken to reduce anthropogenic impacts to loggerhead sea turtles from various sources, particularly since the early 1990s. These include lighting ordinances, predation control, and nest relocations to help increase hatchling survival, as well as measures to reduce the mortality of pelagic immatures, benthic immatures, and sexually mature age classes in various fisheries and other marine activities. Recent actions have taken significant steps towards reducing the environmental baseline and improving the status of all loggerhead subpopulations. For example, the 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.

3.2.5.5 Summary of Status for Loggerhead Sea Turtles

In 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 Australia (Great Barrier Reef and Queensland) and New Caledonia. The abundance of loggerhead sea turtles on nesting colonies throughout the Pacific basin has declined dramatically over the past 10 to 20 years. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead sea 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 extrapolation of nesting information, loggerheads are likely much more numerous than in the Pacific Ocean. NMFS recognizes five recovery units of loggerhead sea turtles in the western North Atlantic based on genetic studies and management regimes. The Biological Review Team has determined that the Northwest Atlantic population of loggerheads meets the Services’ criteria for designation as a DPS (Conant et al. 2009). Cohorts from all of these are known to occur within the action area of this consultation. There are long-term declining nesting trends for the two largest Western Atlantic recovery units: the PFRU and the NRU. Furthermore, no long-term data suggest any of the loggerhead subpopulations throughout the entire North Atlantic are increasing in annual numbers of nests (TEWG 2009). Additionally, using both computation of susceptibility to quasi-extinction and stage-based deterministic modeling to determine the effects of known threats to the Northwest Atlantic DPS, the Loggerhead Biological Review Team determined that this DPS is likely to decline in the foreseeable future, driven primarily by the mortality of juvenile and adult loggerheads from fishery bycatch throughout the North Atlantic

Ocean. These computations were done for each of the recovery units, and all of them resulted in an expected decline (Conant et al. 2009). Because of its size, the PFRU 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. On March 5, 2008, NMFS and USFWS published a 90-day finding that a petitioned request to reclassify loggerhead turtles in the Western North Atlantic Ocean as a distinct population segment may be warranted (73 FR 11849). NMFS and USFWS formed a biological review team to assess the data. The Loggerhead Biological Review Team determined that loggerhead turtles in the Atlantic meet the required characteristics to be separated into three DPSs, the Northwest Atlantic DPS, Northeast Atlantic DPS, and South Atlantic DPS (Conant et al. 2009). NMFS and USFWS will use the information in that review, along with other available information, to determine the listing status (threatened or endangered) for each DPS.

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).

3.2.6 Smalltooth sawfish

The U.S. DPS of smalltooth sawfish was listed as endangered under the ESA on April 1, 2003 (68 FR 15674). Critical habitat for the species was designated on September 2, 2009 (74 FR 45353). The critical habitat consists of two units: the Charlotte Harbor Estuary Unit, which comprises approximately 221,459 acres of coastal habitat; and the Ten Thousand Islands/ Everglades Unit, which comprises approximately 619,013 acres of coastal habitat. The two units are located along the southwestern coast of Florida between Charlotte Harbor and Florida Bay. Historically, smalltooth sawfish occurred commonly in the inshore waters of the Gulf of Mexico and the U.S. Eastern Seaboard up to North Carolina, and more rarely as far north as New York. The current range for the species is considered peninsular Florida (NMFS 2009c). Within this range, smalltooth sawfish can only be found with any regularity in south Florida between the Caloosahatchee River and the Florida Keys (NMFS 2009c).

Life History and Distribution

Smalltooth sawfish are approximately 31 in (80 cm) in total length at birth and may grow to a length of 18 ft (540 cm) or greater. A recent study by Simpfendorfer et al. (2008) suggests rapid juvenile growth occurs during the first two years after birth. First year growth is 26-33 in (65-85 cm) and second year growth is 19-27 in (48-68 cm). Growth rates beyond two years are uncertain; however, the average growth rate of captive smalltooth sawfish has been reported between 5.8 in (13.9 cm) and 7.7 in (19.6 cm) per year. Apart from captive animals, little is known of the species' age parameters (i.e., age-specific growth rates, age at maturity, and maximum age). Simpfendorfer (2000) estimated age at maturity between 10 and 20 years, and a maximum age of 30 to 60 years. Unpublished data from Mote Marine Laboratory (MML) and NMFS indicates male smalltooth sawfish do not reach maturity until they reach 133 in (340 cm).

No directed research on smalltooth sawfish feeding habits exists. Reports of sawfish feeding habits suggest they subsist chiefly on small schooling fish, such as mullets and clupeids. They are also reported to feed on crustaceans and other bottom-dwelling organisms. Observations of sawfish feeding behavior indicate that they attack fish by slashing sideways through schools, and often impale the fish on their rostral (saw) teeth (Breder 1952). The fish are subsequently scraped off the teeth by rubbing them on the bottom and then ingested whole. The oral teeth of sawfish are ray-like, having flattened cusps that are better suited to crushing or gripping.

Very little is known about the specific reproductive biology of the smalltooth sawfish. No confirmed breeding sites have been identified to date since directed research began in 1998. As with all elasmobranchs, fertilization occurs internally. Development in sawfish is believed to be ovoviparous. The embryos of smalltooth sawfish, while still bearing the large yolk sac, resemble adults relative to the position of their fins and absence of the lower caudal lobe. During embryonic development, the rostral blade is soft and flexible. The rostral teeth are also encapsulated or enclosed in a sheath until birth. Shortly after birth, the teeth become exposed and attain their full size, proportionate to the size of the saw. Bigelow and Schroeder (1953) reported gravid females have been documented carrying between 15-20 embryos; however, the source of their data is unclear and may represent an over-estimate of litter size. Studies of largetooth sawfish in Lake Nicaragua (Thorson 1976) report brood sizes of 1-13 individuals, with a mean of 7.3 individuals. The gestation period for largetooth sawfish is approximately 5 months, and females likely produce litters every second year. Although there are no such studies on smalltooth sawfish, their similarity to the largetooth sawfish implies that their reproductive biology may be similar. Genetic research currently underway may assist in determining reproductive characteristics (i.e., litter size and breeding periodicity). Research is also underway to investigate areas where adult smalltooth sawfish have been reported to congregate along the Everglades coast to determine if breeding is occurring in the area.

Life history information on the smalltooth sawfish has been evaluated using a demographic approach and life history data on largetooth sawfish and similar species from the literature. Simpfendorfer (2000) estimates intrinsic rates of natural population increase as 0.08 to 0.13 per year and population doubling times from 5.4 to 8.5 years. These low intrinsic rates of population increase are associated with the life history strategy known as “k-selection.” K-selected animals are usually successful at maintaining relatively small, persistent population sizes in relatively constant environments. Consequently, they are not able to respond effectively (rapidly) to additional and new sources of mortality resulting from changes in their environment. Musick (1999) and Musick et al. (2000) noted that intrinsic rates of increase less than ten percent were low, and such species are particularly vulnerable to excessive mortalities and rapid population declines, after which recovery may take decades. Thus, smalltooth sawfish populations are expected to recover slowly from depletion. Simpfendorfer (2000) concluded that recovery was likely to take decades or longer, depending on how effectively sawfish could be protected.

Smalltooth sawfish are tropical marine and estuarine elasmobranch (e.g., sharks, skates, and rays) fish that are reported to have a circumtropical distribution. The historic range of the smalltooth sawfish in the United States extends from Texas to New York (NMFS 2009c). The U.S. region that has historically harbored the largest number of smalltooth sawfish is south and southwest Florida from Charlotte Harbor to the Dry Tortugas. Most capture records along the Atlantic coast north of Florida are from spring and summer months and warmer water temperatures. Most specimens captured along the Atlantic coast north of Florida have also been large (greater than 10 ft or 3 m) adults and are thought to represent seasonal migrants, wanderers, or colonizers from a core or resident population(s) to the south rather than being resident members of a continuous, even-density population (Bigelow and Schroeder 1953). Historic records from Texas to the Florida Panhandle suggest a similar spring and summer pattern of occurrence. While less common, winter records from the northern Gulf of Mexico suggest a resident population, including juveniles, may have once existed in this region. The Status Review Team (NMFS 2000) compiled information from all known literature accounts, museum collection specimens, and other records of the species. The species suffered significant population decline and range constriction in the early to mid 1900s. Encounters with the species outside of Florida have been rare since that time.

Since the 1990s, the distribution of smalltooth sawfish in the United States has been restricted to peninsular Florida (Seitz and Poulakis 2002; Poulakis and Seitz 2004; Simpfendorfer and Wiley 2005; Mote Marine Laboratory's National Sawfish Encounter Database [MMLNSED]). Encounter data indicates smalltooth sawfish encounters can be found with some regularity only in south Florida from Charlotte Harbor to Florida Bay. A limited number of reported encounters (one in Georgia, one in Alabama, one in Louisiana, and one in Texas) have occurred outside of Florida since 1998.

Peninsular Florida is the main U.S. region that historically and currently hosts the species year-round because the region provides the appropriate climate (subtropical to tropical) and contains the habitat types (lagoons, bays, mangroves, and nearshore reefs) suitable for the species. Encounter data and research efforts indicate a resident, reproducing population of smalltooth sawfish exists only in southwest Florida (Simpfendorfer and Wiley 2005).

Population Dynamics and Status

Despite being widely recognized as common throughout their historic range (Texas to North Carolina) up until the middle of the 20th century, the smalltooth sawfish population declined dramatically during the middle and later parts of the century. The decline in the population of smalltooth sawfish is attributed to fishing (both commercial and recreational), habitat modification, and sawfish life history. Large numbers of smalltooth sawfish were caught as bycatch in the early part of this century. Smalltooth sawfish were historically caught as bycatch in various fishing gears throughout their historic range, including gillnet, otter trawl, trammel net, seine, and to a lesser degree, handline. Frequent accounts in earlier literature document smalltooth sawfish being entangled in fishing nets from areas where smalltooth sawfish were once common but are now rare (Everman and Bean 1898). There are few long-term abundance data sets that include smalltooth sawfish. One dataset from shrimp trawlers off Louisiana from the late 1940s through the 1970s suggests a rapid decline in the species from the period 1950-1964 (NMFS 2009c). However, this dataset has not been validated nor subjected to statistical analysis to correct for factors unrelated to abundance.

The Everglades National Park has established a fisheries monitoring program based on sport fisher dock-side interviews since 1972 (Schmidt et al. 2000). An analysis of these data using a log-normal generalized linear model to correct for factors unrelated to abundance (e.g., change in fishing practices) indicate a slight increasing trend in abundance for smalltooth sawfish in the ENP in the past decade (Carlson et al. 2007). From 1989-2004, smalltooth sawfish relative abundance has increased by about 5 percent per year.

There are no data available to estimate the present population size. Although smalltooth sawfish encounter databases may provide a useful future means of measuring changes in the population and its distribution over time, conclusions about the abundance of smalltooth sawfish now cannot be made because outreach efforts and observation effort is not expanded evenly across each study period.

Threats

Smalltooth sawfish are threatened today by the loss of southeastern coastal habitat through such activities as agricultural and urban development, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff. Dredging, canal development, seawall construction, and mangrove clearing have degraded a significant proportion of the coastline. Smalltooth sawfish have been found near warm water discharge areas near power plants. Power plant discharges may provide a warm water refuge for the species during cold weather conditions. Smalltooth sawfish, especially small juveniles (less than 79 in or 200 cm in length) are vulnerable to coastal habitat degradation due to their use of shallow, red mangrove, estuarine habitats for foraging and to avoid predation from sharks.

Recreational and commercial fisheries also still pose a threat to smalltooth sawfish. Although changes over the past decade to U.S. fishing regulations such as Florida's net ban have reduced this threats to the species over parts of its range, smalltooth sawfish are still incidentally caught in commercial shrimp trawls, bottom longlines, and recreational rod-and-reel.

The current and future abundance of the smalltooth sawfish is limited by its life history characteristics (NMFS 2000). Slow-growing, late-maturing, and long-lived, these combined characteristics result in a very low intrinsic rate of population increase and are associated with the life history strategy known as "k-selection." As noted earlier in this section, k-selected animals are usually successful at maintaining relatively small, persistent population sizes in relatively constant environments. Consequently, they are not able to respond effectively (rapidly) to additional and new sources of mortality resulting from changes in their environment (Musick 1999). Simpfendorfer (2000) demonstrated that the life history of this species makes it impossible to sustain any significant level of fishing and makes it slow to recover from any population decline. Thus, the species is susceptible to population decline, even with relatively small increases in mortality.

4.0 Environmental Baseline

By regulation, environmental baselines for opinions include the past and present impacts of all state, federal or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02).

This section contains a description of the effects of past and ongoing human factors leading to the current status of the species, their habitat, and ecosystem, within the action area. The environmental baseline is a snapshot of the factors affecting the species and includes 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 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. The purpose of describing the environmental baseline in this manner is to provide context for the effects of the proposed action on the listed species.

4.1 Status of Species in the Action Area

The five species of sea turtles that occur in the action area are all highly migratory. NMFS believes that few, if any, individual members of any of the species are likely to be year-round residents of the action area. Individual animals will likely make migrations into nearshore waters of the Gulf as well as other areas of the North Atlantic Ocean, including the Caribbean Sea. Therefore, the status of the five species of sea turtles in the action area, as well as the threats to these species, are best reflected in their range-wide statuses and supported by the species accounts in Section 3 (Status of Species).

Smalltooth sawfish greater than 200 cm TL may be found in the southern portion (primarily off Florida) of the action area throughout the year intermittently, spending the rest of their time in shallower waters. The status of smalltooth sawfish in the action area, as well as the threats to this species, is best reflected in their range-wide statuses and supported by the species accounts in Section 3 (Status of Species).

4.2 Factors Affecting Sea Turtles in the Action Area

As stated in Section 2.4 (Action Area), the proposed action occurs in the Gulf of Mexico EEZ. The following analysis examines actions that may affect these species’ environment specifically within this defined action area. The environmental baseline for this opinion includes the effects of several activities affecting the survival and recovery of ESA-listed sea turtle species in the action area. The activities that shape the environmental baseline in the action area of this consultation are primarily federal fisheries. Other environmental impacts include effects of vessel operations, additional military activities, dredging, oil and gas exploration, permits allowing take under the ESA, private vessel traffic, and marine pollution.

4.2.1 Federal Actions

NMFS has undertaken a number of section 7 consultations to address the effects of federally-permitted fisheries and other federal actions on threatened and endangered sea turtle species, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to minimize the adverse impacts of the action on sea turtles. Similarly, NMFS has undertaken recovery actions under the ESA to address sea turtle takes in the fishing and shipping industries and other activities such as Army Corps of Engineers (COE) dredging operations. The summary below of federal action and the effects these actions have had on sea turtles includes only those federal actions in the action area which have already concluded or are currently undergoing formal section 7 consultation.

4.2.1.1 Fisheries

Threatened and endangered sea turtles are adversely affected by fishing gears used throughout the continental shelf of the action area. Gillnet, pelagic and bottom longline, other types of hook-and-line gear, trawl, and pot fisheries have all been documented as interacting with sea turtles.

For all fisheries for which there is an FMP or for which any federal action is taken to manage that fishery, impacts have been evaluated under section 7. As described in Section 1.0 and 2.0, formal consultation has previously been conducted on the Gulf reef fish fishery. Formal section 7 consultations have also been conducted on the following fisheries, occurring at least in part within the action area, found likely to adversely affect threatened and endangered sea turtles: Southeast shrimp trawl, Atlantic Highly Migratory Species(HMS) pelagic longline, HMS directed shark, reef fish, and coastal migratory pelagic resources fisheries. Anticipated take levels associated with these actions are presented in Appendix 2; the take levels reflect the impact on sea turtles and other listed species of each activity anticipated from the date of the ITS forward in time.

Southeastern shrimp trawl fisheries
U.S. Gulf shrimp fisheries target primarily brown, white, and pink shrimp. Brown, white, and pink shrimp are subjected to fishing from inland waters and estuaries through the state-regulated territorial seas and into federal waters of the EEZ. Brown shrimp, which are the most important species in the Gulf fishery, are caught out to at least 50 fathoms, but most come from waters less than 30 fathoms. White shrimp, second in value, are found in nearshore waters to 20 fathoms, with most of the catch coming from less than 15 fathoms (i.e., mainly inshore of the action area). Pink shrimp are most abundant off Florida's west coast and particularly in the Tortugas off the Florida Keys.

Shrimp trawling has had the greatest adverse effect on seas turtle in the Gulf of Mexico. As sea turtles rest, forage, or swim on or near the bottom, they are captured by shrimp trawls pulled along the bottom. Shrimp trawling increased dramatically in the action area between the 1940s and the 1960s. By the late 1970s, there was evidence thousands of sea turtles were being killed annually in the Southeast (Henwood and Stunz 1987). In 1990, the NRC concluded the Southeast shrimp trawl fishery affected more sea turtles than all other activities combined and was the most significant anthropogenic source of sea turtle mortality in the U.S. waters, in part due to the high reproductive value of turtles taken in this fishery (NRC 1990). Of the five species of sea turtles affected by shrimp trawling, the extent of take on loggerhead sea turtles is by far the greatest.

NMFS has prepared opinions on the Gulf of Mexico shrimp trawling numerous times over the years (i.e., NMFS 1992, 1994, 1996a, 1996b, 1998). The consultation history is closely tied to the lengthy regulatory history governing the use of TEDs and a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial shrimp trawl fisheries. The level of annual mortality described in NRC (1990) is believed to have continued until 1992-1994, when U.S. law required all shrimp trawlers in the Atlantic and Gulf of Mexico to use turtle excluder devices (TEDs), which allowed some turtles to escape nets before drowning (NMFS 2002b). TEDs approved for use have had to demonstrate 97 percent effectiveness in excluding sea turtles from trawls in controlled testing. 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), flotation, and more widespread use.

Despite the success of TEDs for some species of sea turtles, it was later discovered that TEDs were not adequately protecting all species and size classes of sea turtles. Analyses by Epperly and Teas (2002) indicated that the minimum requirements for the escape opening dimension 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 and Gulf of Mexico were too large to fit the existing openings.

On December 2, 2002, NMFS completed the most recent opinion for shrimp trawling in the southeastern U.S. (NMFS 2002b) 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.

In addition to improvements in TED designs and TED enforcement, interactions between sea turtles and the shrimp fishery have also been declining because of reductions of fishing effort unrelated to fisheries management actions. The 2002 shrimp opinion take estimates are based in part on fishery effort levels. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of recent hurricanes in the Gulf of Mexico have all impacting the shrimp fleets; in some cases reducing fishing effort by as much as 50 percent for offshore waters of the Gulf of Mexico (GMFMC 2007). As a result, sea turtle interactions and mortalities have been substantially less than projected in the 2002 shrimp opinion. Estimated annual number of interactions between sea turtles and shrimp trawls in the Gulf shrimp fishery and estimated mortalities under the new regulation (68 FR 8456, February 21, 2003) based on Epperly et al. (2002) estimated CPUEs but updated with 2007 effort data from the Gulf of Mexico taken from Nance et al. (2008) are provided in Table 4.1.

Table 4.1: Estimated annual number of interactions between sea turtles and shrimp trawls in the Gulf of Mexico shrimp fishery and associated estimated mortalities based on 2007 Gulf effort data taken from Nance et al. (2008) (December 8, 2008, Memorandum from Dr. Ponwith to Dr. Crabtree; Data Analysis Request: Update of turtle bycatch in the Gulf of Mexico shrimp fishery)

Species	Estimated Interactions	Estimated Mortalities
Leatherback	520	15
Loggerhead	23,336	647
Kemp's ridley	98,184	2,716
Green	11,311	319

Atlantic pelagic longline fisheries

Atlantic pelagic longline fisheries targeting swordfish and tuna are also known to incidentally capture large numbers of loggerhead and leatherback sea turtles. U.S. pelagic longline fishermen began targeting highly migratory species in the Atlantic Ocean in the early 1960s. The fishery is comprised of five relatively distinct segments, including: the Gulf yellowfin tuna fishery (the only segment in our action area); 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 the Caribbean tuna and swordfish fishery. Pelagic longlines targeting yellowfin tunas in the Gulf are set in the morning (pre-dawn) in deep water and hauled in the evening. Although this fishery does occur in the Gulf EEZ, fishing typically occurs further offshore than where reef fish fishing occurs. The fishery mainly interacts with leatherback sea turtles and pelagic juvenile loggerhead sea turtles, thus, younger, smaller loggerhead sea turtles than the other fisheries described in this environmental baseline.

Over the past two decades, NMFS has conducted numerous consultations on this fishery, some of which required RPAs to avoid jeopardy of loggerhead and/or leatherback sea turtles. The estimated historical total number of loggerhead and leatherback sea turtles caught between 1992-2002 (all geographic areas) is 10,034 loggerhead and 9,302 leatherback sea turtles of which 81 and 121 were estimated to be dead when brought to the vessel (NMFS 2004b). This does not account for post-release mortalities, which historically was likely substantial.

NMFS most recently reinitiated consultation in 2004 on the pelagic longline component of this fishery as a result of exceeded incidental take levels for loggerheads and leatherbacks (NMFS 2004b). The resulting opinion (i.e. NMFS 2004b) stated the long-term continued operation of this sector of the fishery was likely to jeopardize the continued existence of leatherback sea turtles, but RPAs were implemented allowing for the continued authorization of the pelagic longline fishing that would not jeopardize leatherback sea turtles.

On July 6, 2004, NMFS published a final rule to implement management measures to reduce bycatch and bycatch mortality of Atlantic sea turtles in the Atlantic pelagic longline fishery (69 FR 40734). The management measures include mandatory circle hook and bait requirements, and mandatory possession and use of sea turtle release equipment to reduce bycatch mortality. The rulemaking, based on the results of the 3-year Northeast Distant Closed Area research experiment and other available sea turtle bycatch reduction studies, is expected to have significant benefits to endangered and threatened sea turtles by reducing mortality attributed to this fishery.

Atlantic HMS Directed Shark fisheries

Atlantic HMS commercial directed shark fisheries also adversely affect sea turtles via capture and/or entanglement in the action area. The commercial component uses bottom longline and gillnet gear. Bottom longline is the primary gear used to target large coastal sharks (LCS) in the Gulf. The largest concentration of bottom longline fishing vessels is found along the central Gulf coast of Florida, with the John's Pass - Madeira Beach area considered the center of directed shark fishing activities. Gillnets are the dominant gear for catching small coastal sharks; most shark gillnetting occurs off Southeast Florida, outside of the action area.

Growing demand for shark and shark products encouraged expansion of the commercial shark fishery through the 1970s and 1980s. As catches accelerated through the 1980s, shark stocks started to show signs of decline. Peak commercial landings of large coastal and pelagic sharks were reported in 1989.

Atlantic sharks have been managed by NMFS since the 1993 FMP for Atlantic Sharks. At that time, NMFS identified LCS as overfished and implemented commercial quotas for LCS (2,436 mt dressed weight (dw)) and established recreational harvest limits for all sharks. In 1994, under the rebuilding plan implemented in the 1993 Shark FMP, the LCS quota was increased to 2,570 mt dw; in 1997, NMFS reduced the LCS commercial quota by 50 percent to 1,285 mt dw and the recreational retention limit to two LCS, SCS, and pelagic sharks combined per trip with an additional allowance of two Atlantic sharpnose sharks per person per trip (62 FR 16648, April 2, 1997). Since 1997, the directed LCS fishing season has generally been open for the first three months of the year and then a few weeks in July/August.

Observation of directed HMS shark fisheries as been ongoing since 1994, but a mandatory program was not implemented until 2002. Neritic juvenile and adult loggerhead sea turtles are the primary species taken, but leatherback sea turtles have also been observed caught and a few observations have been unidentified species of turtles. Between 1994 and 2002, the program covered 1.6 percent of all hooks, and over that time period caught 31 loggerhead sea turtles, 4 leatherback sea turtles, and 8 unidentified with estimated annual average take levels of 30, 222, and 56, respectively (NMFS 2003a).

NMFS recently completed a section 7 consultation on the continued authorization of directed Atlantic HMS shark fisheries under the Consolidated HMS FMP, including Amendment 2 (NMFS 2008). To protect declining shark stocks, Amendment 2 sought to greatly reduce the fishing effort in the commercial component of the fishery. These reductions are likely to greatly reduce the interactions between the commercial component of the fishery and sea turtles. Amendment 2 to the Consolidated HMS Fishery Management Plan (FMP) (73 FR 35778, June 24, 2008, corrected at 73 FR 40658, July 15, 2008) established, among other things, a shark research fishery to maintain time series data for stock assessments and to meet NMFS' 2009 research objectives. The shark research fishery permits authorize participation in the shark research fishery and the collection of sandbar and non-sandbar large coastal sharks (LCS) from federal waters in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea for the purposes of scientific data collection subject to 100 percent observer coverage. The commercial vessels selected to participate in the shark research fishery are the only vessels authorized to land/harvest sandbars subject to the sandbar quota available for each year. The base quota is 87.9 mt dw/year through December 31, 2012, although this number may be reduced in the event of overharvests, if any, and 116.6 mt dw/year starting on January 1, 2013. The selected vessels have access to the non-sandbar LCS, small coastal shark (SCS), and pelagic shark quotas. Commercial vessels not participating in the shark research fishery may only land non-sandbar LCS, SCS, and pelagic sharks subject to the retention limits and quotas per 50 CFR 635.24 and 635.27, respectively. The 2008 opinion stated that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by the bottom longline and the gillnet fishery. However, the proposed action was not expected to jeopardize the continued existence of any of these species and an ITS was provided. Since implementation of Amendment 2, only one sea turtle (a loggerhead) has been observed caught in the research fishery. Also, vessels fishing outside of the research fishery have 5 to 8 percent observer coverage, and no sea turtles have been observed to date.

Gulf reef fish fishery

The history of the Gulf reef fishery is provided in Section 2. The extent of past impacts on sea turtles from reef fish fishing is unknown, but we opine was likely much greater than previously thought, based on recent observer data. Stemming from a 2005 opinion requirement, NMFS published a final rule to implement sea turtle release gear requirements and sea turtle careful release protocols in the Gulf reef fish fishery on August 9, 2006 (71 FR 45428). The rule requires owners and operators of vessels with federal commercial or charter vessel/headboat permits for Gulf reef fish to comply with sea turtle (and smalltooth sawfish) release protocols and have on board specific sea turtle release gear. Although these regulations may have reduced post-release mortality in this fishery in recent years, at-vessel mortality in the past has likely remained unchanged.

Coastal Migratory Pelagic Resources Fisheries

NMFS completed a section 7 consultation on the continued authorization of the coastal migratory pelagic resources fishery in the Gulf of Mexico and South Atlantic (NMFS 2007a). In the Gulf of Mexico, commercial fishermen target king and Spanish mackerel with hook-and-line (i.e., handline, rod-and-reel, and bandit), gillnet, and cast net gears. Recreational fishermen use only rod-and-reel. Trolling is the most common hook-and-line fishing technique used by both commercial and recreational fishermen. Although run-around gillnets accounted for the majority of the king mackerel catch from the late 1950s through 1982, in 1986, and in 1993, handline gear has been the predominant gear used in the commercial king mackerel fishery since 1993 (NMFS 2007a). A winter troll fishery operates along the east and south Gulf coast. The gillnet fishery for king mackerel is restricted to the use of "run-around" gillnets in Gulf to Monroe and Collier Counties in January. Run-around gillnets are still the primary gear used to harvest Spanish mackerel, but the fishery is relatively small because Spanish mackerel are typically more concentrated in state waters where gillnet gear is prohibited. The 2007 opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected only by the gillnet component of the fishery. The continued authorization of the fishery was not expected to jeopardize the continued existence of any of these species and an ITS was provided.

Gulf Spiny Lobster Fishery
NMFS completed a section 7 consultation on the Gulf and South Atlantic Spiny Lobster FMP on August 27, 2009 (i.e., NMFS 2009d). The commercial component of the fishery consists of diving, bully net and trapping sectors; recreational fishers are authorized to use bully net and hand-harvest gears. Of the gears used, traps are expected to result in adverse effects on sea turtles. In the Gulf, fishing activity is limited to waters off southwest Florida and, although the FMP does authorize the use of traps in federal waters, historic and current effort is very limited. Thus, potential adverse effects on sea turtles are believed to also be very limited (e.g., no more than a couple sea turtle entanglements annually). The consultation determined the continued authorization of the fishery would not jeopardize any listed species. An ITS was issued for takes in the commercial trap sector of the fishery.

4.2.1.2 Vessel Operations and Additional Military Activities

Potential sources of adverse effects from federal vessel operations in the action area include operations of the U.S. Department of Defense (DOD), USN, Air Force (USAF), USCG, Environmental Protection Agency (EPA), NOAA, and COE. NMFS has also conducted section 7 consultations on vessel traffic related to energy projects in the Gulf of Mexico (MMS, FERC, and MARAD) to implement conservation measures. Through the section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. However, at the present time they present the potential for some level of interaction. The USCG has recently engaged NMFS in consultation on these actions to determine the magnitude of the adverse impacts resulting from these events in nearshore waters. Consultations on individual activities have been completed (e.g., NMFS 1995b, NMFS 1997), but no formal consultation on overall USCG or USN activities in any region have been completed at this time. Refer to the opinions for the USCG (NMFS 1995b) and the USN (NMFS 1997) for details on the scope of vessel operations for these agencies and conservation measures being implemented as standard operating procedures.

The USN consultation only covered operations out of Mayport, Florida, and the potential exists for USN vessels to adversely affect sea turtles when they are operating in other areas within the range of these species. The Navy is currently in formal consultation with NMFS on activities (including vessel operations) in the Gulf of Mexico Range Complex, and potential adverse effects in the Gulf of Mexico will be considered in that opinion. Operations of vessels by other federal agencies within the action area (NOAA, EPA, COE) may adversely affect sea turtles. However, the in-water activities of those agencies are limited in scope, as they operate a limited number of vessels or are engaged in research/operational activities that are unlikely to contribute a large amount of risk.

Additional activities such as ordnance detonation also affect listed species of sea turtles. Section 7 consultations were conducted for USN aerial bombing training in the ocean off the southeast U.S. coast, involving drops of live ordnance (500- and 1,000-lb bombs) (NMFS 1997). These consultations determined each activity was likely to adversely affect sea turtles but would not jeopardize their continued existence. An ITS was issued for each activity.

NMFS has also consulted on military training operations conducted by the U.S. Air Force (USAF) and U.S. Marine Corps (USMC). From 1995-2007, two consultations have been completed that evaluated the impacts of ordnance detonation during gunnery training or aerial bombing exercises (NMFS 2004c, NMFS 2005b). These consultations determined each activity was likely to adversely affect sea turtles but would not jeopardize their continued existence. An ITS was issued for each activity. A consultation evaluating the impacts from USAF search-and-rescue training operations in the Gulf of Mexico was completed in the 1999 (NMFS 1999c). This consultation determined the training operations would adversely affect sea turtles but would not jeopardize their continued existence and an ITS was issued.

4.2.1.3 Oil and Gas Exploration

Federal and state oil and gas exploration, production, and development are expected to result in some sublethal effects due to seismic exploration a effects to protected species as reported in the analysis of federal activities for oil and gas lease sale biological opinions with the MMS, including impacts associated with the explosive removal of offshore structures, seismic exploration, marine debris, oil spills, and vessel operation. Many section 7 consultations have been completed on MMS oil and gas lease activities. Until 2002, these biological opinions concluded that one take of sea turtles may occur annually due to vessel strikes. Opinions issued on July 11, 2002 (NMFS 2002c), November 29, 2002 (NMFS 2002d), August 30, 2003 (Lease Sales 189 and 197, NMFS 2003b), and June 29, 2007 (2007-2012 Five-Year Lease Plan, NMFS 2007b) have concluded that takes of sea turtles may result from vessel strikes, marine debris, and spilled oil.

Explosive removal of offshore structures may adversely affect sea turtles. In an August 28, 2006 opinion, NMFS issued incidental take for MMS-permitted structure removals (NMFS 2006a). In July 2004, MMS completed a programmatic environmental assessment (PEA) on geological and geophysical exploration on the GOM Outer Continental Shelf, and a programmatic consultation for the GOM is that will consider the effects to sea turtles is currently underway for those activities throughout the northern Gulf of Mexico.

4.2.1.4 ESA Permits

Sea turtles are the focus of research activities authorized by section 10 permits under the ESA. Regulations developed under the ESA allow for the issuance of permits allowing take of certain ESA-listed species for the purposes of scientific research under section 10(a)(1)(a) of the ESA. As of January 2009, there were 10 active scientific research permits directed toward sea turtles that are applicable to the action area of this opinion. Authorized activities range from photographing, weighing, and tagging sea turtles incidentally taken in fisheries, to blood sampling, tissue sampling (biopsy), and performing laparoscopy on intentionally captured sea turtles. The number of authorized takes varies widely depending on the research and species involved, but may involve the taking of hundreds of sea turtles annually. Most takes authorized under these permits are expected to be (and are) non-lethal. Before any research permit is issued, the proposal must be reviewed under the permit regulations (i.e., must show a benefit to the species). In addition, since issuance of the permit is a federal activity, issuance of the permit by NMFS must also be reviewed for compliance with section 7(a)(2) of the ESA to ensure that issuance of the permit does not result in jeopardy to the species or adverse modification of its critical habitat.

4.2.2 State or Private Actions

4.2.2.1 Vessel Traffic

Commercial traffic and recreational boating pursuits can have adverse effects on sea turtles via propeller and boat strike damage. The Sea Turtle Stranding and Salvage Network (STSSN) includes many records of vessel interactions (propeller injury) with sea turtles off Gulf of Mexico coastal states such as Florida, where there are high levels of vessel traffic.

4.2.3 Other Potential Sources of Impacts in the Environmental Baseline

4.2.3.1 Marine Debris and Acoustic Impacts

A number of activities that may indirectly affect listed species in the action area of this consultation include anthropogenic marine debris and acoustic impacts. The impacts from these activities are difficult to measure. Where possible, conservation actions are being implemented to monitor or study impacts from these sources.

4.2.3.2 Marine Pollution

Anthropogenic sources of marine pollution, while difficult to attribute to a specific federal, state, local or private action, may indirectly affect sea turtles in the action area. Sources of pollutants along the Gulf include atmospheric loading of pollutants such as PCBs and stormwater runoff from coastal towns and cities into rivers and canals emptying into bays and the ocean (e.g., Mississippi River). 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.

Nutrient loading from land-based sources such as agricultural and coastal community stormwater and sanitary discharges is known to stimulate plankton blooms in closed or semi-closed estuarine systems. An example is the large area of the Louisiana continental shelf with seasonally depleted oxygen levels (< 2mg/l), caused by eutrophication from both point and non-point sources. Most aquatic species cannot survive at such low oxygen levels and these areas are known as “dead zones.” The oxygen depletion, referred to as hypoxia, begins in late spring, reaches a maximum in mid summer, and disappears in the fall. Since 1993, the average extent of mid-summer bottom-water hypoxia in the northern Gulf of Mexico has been approximately 16,000 square kilometers, approximately twice the average size measured between 1985 and 1992. The hypoxic zone attained a maximum measured extent in 2001, when it was 21,700 square kilometers (Rabalais et al. 2002). The hypoxic zone has impacts on the animals found there, including sea turtles, and the ecosystem-level impacts continue to be investigated.

4.2.4 Conservation and Recovery Actions Benefiting Sea Turtles

NMFS has implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles from commercial fisheries in the action area. These include sea turtle release gear requirements for Atlantic HMS and Gulf of Mexico reef fish and TED requirements for the Southeast shrimp trawl fishery. These regulations have relieved some of the pressure on sea turtle populations.

Under section 6 of the ESA, NMFS may enter into cooperative research and conservation agreements with states to assist in recovery actions of listed species. In the Gulf of Mexico, NMFS currently has an agreement with the State of Florida and is finalizing an agreement with Texas. Prior to issuance of these agreements, the proposal must be reviewed for compliance with section 7 of the ESA.

Outreach and Education, Sea Turtle Entanglements, and Rehabilitation
NMFS and cooperating states have established an extensive network of Sea Turtle Stranding and Salvage Network (STSSN) participants along the Atlantic and Gulf of Mexico coasts that not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded sea turtles.

Sea Turtle Handling and Resuscitation Techniques
NMFS published a final rule (66 FR 67495, December 31, 2001) detailing handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the final rule. These measures help to prevent mortality of hard-shelled turtles caught in fishing or scientific research gear. There is 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.

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

On August 3, 2007, NMFS published a final rule required selected fishing vessels to carry observers on board to collect data on sea turtle interactions with fishing operations, to evaluate existing measures to reduce sea turtle takes, and to determine whether additional measures to address prohibited sea turtle takes may be necessary (72 FR 43176). This rule also extended the number of days NMFS observers placed in response to a determination by the Assistant Administrator that the unauthorized take of sea turtles may be likely to jeopardize their continued existence under existing regulations, from 30 to 180 days.

Other Actions

A revised recovery plan for the loggerhead sea turtle was completed December 8, 2008 (NMFS and USFWS 2008). The recovery plan for the Kemp's ridley sea turtle is 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. Five-year status reviews have recently been completed for green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. These reviews were conducted to comply with the ESA mandate for periodic status evaluation of listed species to ensure that their threatened or endangered listing status remains accurate. Each review determined that no delisting or reclassification of a species status (i.e., threatened or endangered) was warranted at this time. However, further review of species data for the green, hawksbill, leatherback, and loggerhead sea turtles was recommended, to evaluate whether distinct population segments (DPS) should be established for these species (NMFS and USFWS 2007a-e).

4.2.5 Summary and Synthesis of Environmental Baseline for Sea Turtles

In summary, several factors adversely affect sea turtles in the action area. These factors are ongoing and are expected to occur contemporaneously with the proposed action. Fisheries in the action area likely had the greatest adverse impacts on sea turtles in the mid to late 80's, when effort in most fisheries was near or at peak levels. With the decline of the health of managed species, effort since that time has generally been declining. Over the past five years, the impacts associated with fisheries have also been reduced through the section 7 consultation process and regulations implementing effective bycatch reduction strategies. However, interactions with commercial and recreational fishing gear are still ongoing and are expected to occur contemporaneously with the proposed action. Other environmental impacts including effects of vessel operations, additional military activities, dredging, oil and gas exploration, permits allowing take under the ESA, private vessel traffic, and marine pollution have also had and continue to have adverse effects on sea turtles in the action area in the past, but to a lesser degree of magnitude.

4.3 Factors Affecting Smalltooth Sawfish Within the Action Area

Smalltooth sawfish are not highly migratory species, although some large mature individuals may engage in seasonal north/south movement. The U.S. DPS of smalltooth sawfish is confined to only a small portion of the action area; smalltooth sawfish greater than 200 cm TL may be found in the southern portion (primarily off Florida) of the action area intermittently throughout the year, spending the rest of their time in shallower waters. Individuals found in the action area can potentially be affected by activities both within the southeast portion of the action area and adjacent nearshore waters. Based on this information, the range-wide status of smalltooth sawfish described in Section 3 most accurately reflects the species' status within the action area.

4.3.1 Federal Actions

In recent years, NMFS has undertaken section 7 consultations to address the effects of federally-permitted fisheries and other federal actions on smalltooth sawfish, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to minimize the adverse impacts of the action on smalltooth sawfish. The following sections summarize anticipated sources of incidental take of smalltooth sawfish in the Gulf EEZ, which have already concluded formal section 7 consultation.

Fisheries

Gulf *HMS shark fisheries* include commercial shark bottom longline and drift gillnet fisheries and recreational shark fisheries under the FMP for Atlantic Tunas, Swordfish, and Sharks (HMS FMP). NMFS has consulted formally twice on effects of HMS shark fisheries on smalltooth sawfish (i.e., NMFS 2003a and NMFS 2008). Both bottom longline and gillnet are known to adversely affect smalltooth sawfish. The observer program for sharks covered approximately 598,384 hooks or 1.6 percent of all hooks in the bottom longline fleet between 1994 and 2002. Over that time, eight smalltooth sawfish were observed caught and of these, only one was within our Gulf action area. Since then, four additional smalltooth sawfish have been caught on shark bottom longlines, but they have all been in the Atlantic. Only one smalltooth sawfish has been observed incidentally caught in the shark drift gillnet fishery and this capture occurred in the Atlantic, where the shark drift gillnet fishery predominantly operates.

The most recent ESA section 7 consultation was completed on May 20, 2008, on the continued operation of those fisheries and Amendment 2 to the Consolidated HMS FMP (NMFS 2008). The consultation concluded the proposed action was not likely to jeopardize the continued existence of the smalltooth sawfish. An ITS was provided authorizing 51 takes every three years, only 1 of which is expected to be lethal. Based on past interactions, the majority of these takes will be in the Atlantic, outside of the action area.

Several other federal fisheries in the Gulf are believed to adversely affect smalltooth sawfish, including the Gulf shrimp trawl, coastal migratory pelagic resources, and spiny lobster fisheries. All of these fisheries have been consulted on separately and were determined to not be likely to jeopardize the continued existence of smalltooth sawfish (NMFS 2006b, NMFS 2007a, NMFS 2009d). An ITS was provided for each fishery. The Gulf Shrimp trawl fishery is anticipated to result in up to one take annually, anticipated to be lethal. The coastal migratory pelagic resources fishery is anticipated to result in two non-lethal smalltooth sawfish takes annually entanglement in gillnet gear. The Gulf spiny lobster fishery is anticipated to result in only two smalltooth sawfish every three years via entanglement in trap lines.

ESA Permits

Regulations developed under the ESA allow for the taking of ESA-listed species for scientific research purposes. Prior to issuance of these authorizations for taking, the proposal must be reviewed for compliance with section 7 of the ESA. There are currently two active research permits issued for the smalltooth sawfish. The permit allows researchers to capture, handle, collect tissue and blood samples, and tag smalltooth sawfish. Although the research may result in disturbance and injury of smalltooth sawfish, the activities are not expected to affect the reproduction of the individuals that are caught, nor result in mortality.

4.3.2 State or Private Actions

The incidental capture of sawfish by private recreational fishermen has been documented in the action area and adjacent nearshore areas. Additionally, lost fishing gear such as line cut after snagging on rocks, or discarded hooks and line, can also pose an entanglement threat to sea turtles in the area.

4.3.3 Other Potential Sources of Impacts in the Environmental Baseline

Marine Pollution
The toothed rostrum been encountered with polyvinyl pipes and fishing gear on their rostrum (Gregg Poulakis pers. comm. 2007). The same sources of pollutants described in section 4.2.3.2 may also adversely affect smalltooth sawfish.

4.3.4 Conservation and Recovery Actions Shaping the Environmental Baseline

Regulations restricting the use of gear known to incidentally catch smalltooth sawfish may benefit the species by reducing their incidental capture and/or mortality in these gear types. In 1994, entangling nets (including gillnets, trammel nets, and purse seines) were banned in Florida state waters. Although intended to restore the populations of inshore gamefish, this action removed possibly the greatest source of fishing mortality on smalltooth sawfish (Simpfendorfer 2002). Florida's ban of the use of shrimp trawls within three nautical miles of the Gulf coast may also aid recovery of this species.

Research, monitoring, and outreach efforts on smalltooth sawfish are providing valuable information on which to base effective conservation management measures. Research on smalltooth sawfish is currently being conducted by NMFS SEFSC and the FWCC, Fish and Wildlife Research Institute, and the Florida Museum of Natural History (FLMNH) at the University of Florida. Surveys are conducted using longlines, setlines, gillnets, and seine nets in southwest Florida, as well as in South Florida and the northern Indian River Lagoon. Cooperating fishermen, guides, and researchers are also reporting smalltooth sawfish they encounter. Data collected are providing new insight on the species' current distribution, abundance, and habitat use patterns.

Public outreach efforts are also helping to educate the public on smalltooth sawfish status and proper handling techniques and helping to minimize interaction, injury, and mortality of encountered smalltooth sawfish. Information regarding the status of smalltooth sawfish and what the public can do to help the species is available on the Web site of the FLMNH,[5] NMFS,[6] and the Ocean Conservancy.[7] Reliable information is also available at websites maintained by noted sawfish expert Matthew McDavitt.[8] These organizations and individuals also educate the public about sawfish status and conservation through regular presentations at various public meetings.

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[5] http://www.flmnh.ufl.edu/fish/Sharks/Sawfish/SRT/srt.htm
[6] http://www.sero.nmfs.noaa.gov/pr/SmalltoothSawfish.htm
[7] http://www.oceanconservancy.org/site/PageServer?pagename=fw_sawfish
[8] http://hometown.aol.com/nokogiri/

In September 2003, NMFS convened a smalltooth sawfish recovery team. Under section 4(f)(1) of the ESA, NMFS is required to develop and implement recovery plans for the conservation and survival of endangered and threatened species. Such plans are to include: (1) A description of site-specific management actions necessary to conserve the species or populations; (2) objective, measurable criteria which, when met, will allow the species or populations to be removed from the endangered and threatened species list; and (3) estimates of the time and funding required to achieve the plan's goals and intermediate steps. The final smalltooth sawfish recovery plan published on January 21, 2009.

4.3.5 Summary of Environmental Baseline

In summary, several factors are presently adversely affecting smalltooth sawfish in the action area. These factors are ongoing and are expected to occur contemporaneously with the proposed action. Despite smalltooth sawfish being highly susceptible to entanglement, few interactions are documented. Impacts on smalltooth sawfish over the last several decades may be limited in large part by the scarcity of smalltooth sawfish in the action area. As the population slowly grows, fisheries and other activity stressors in the action area may have a greater impact on the species.

5.0 Effects of the Action

In this section, we assess the probable direct and indirect effects of the continued authorization of the Gulf reef fish fishery on listed species that are likely to be adversely affected. The analysis in this section forms the foundation for our jeopardy analysis in Section 7.0. The quantitative and qualitative analyses in this section are based upon the best available commercial and scientific data on sea turtle and smalltooth sawfish biology and the effects of the proposed action. Data pertaining to the Gulf reef fish fishery relative to interactions with sea turtles and smalltooth sawfish are limited, so we are often forced to make assumptions to overcome the limits in our knowledge. Frequently, 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 (i.e., would lead to conclusions of higher, rather than lower, risk to endangered or threatened species).

When analyzing the effects of any action, it is important to consider indirect effects as well as the direct effects. Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Indirect effects include aspects such as habitat degradation, reduction of prey/foraging base, etc. For the proposed action analyzed in this opinion, there are no expected indirect effects to sea turtles or smalltooth sawfish. The authorization of the Gulf reef fish fishery (i.e., vessel operations, gear deployment and retrieval) is not expected to impact the water column or benthic habitat in any measurable manner. Unlike mobile trawls and dredges that physically disturb habitat as they are dragged along the bottom, the gears used in the Gulf reef fish fishery are suspended in the water column or are relatively stationary on the bottom and do not effect water column or benthic habitat characteristics in any manner that would impact listed species. The fishery's target and bycatch species are not foraged on by sea turtles nor are they a primary prey species for smalltooth sawfish (Hopkins et al. 2003, Simpfendorfer 2001) so prey competition is also not a factor. Therefore, all analyses will center on direct effects.

Approach to Assessment

We began our analysis of the effects of the action by first evaluating what activities and gear types/techniques are likely to adversely affect sea turtles and smalltooth sawfish (i.e., what the proposed action stressors are). We determined effects of the Gulf reef fish fishery on threatened and endangered species result from interactions with associated vessels or fishing gear leading to the capture, injury, or death of individual sea turtles and smalltooth sawfish. In NMFS (2005a), we determined there would only be adverse effects from reef fish fishing gears on listed species; we did not determine there would be adverse effects attributed to vessel strikes. However, with increasing awareness of this growing problem (e.g., see Foley et al. 2008), in this opinion we make a first attempt at estimating the Gulf reef fish fishery's possible contribution to this problem. Our analyses assume sea turtles and smalltooth sawfish are not likely to be adversely affected unless they come in physical contact with a moving vessel or fishing gear. We also assume the potential effects of each gear type are proportional to the number of interactions between the gear and each species.

Although there are two general types of gear currently used in the Gulf reef fish fishery, spear and power head gear and hook-and-line gear,[9] the analyses of the effects of fishing gear focus solely on the effects of hook-and-line gear on sea turtles and smalltooth sawfish. This is because in NMFS (2005a) we determined spear and power head gear were not likely to adversely affect sea turtles or smalltooth sawfish, and we still believe this to be true. Commercial and recreational divers (either free diving or more typically with SCUBA) fishing with these gears do occasionally encounter sea turtles, and very rarely, smalltooth sawfish. However, anecdotal information from such encounters indicates some sea turtles and smalltooth sawfish change their route to avoid coming in close proximity to divers, whereas others appear unaware of the presence of divers. Regardless, there are no reports of sea turtles or smalltooth sawfish being incidentally struck by this gear type. Given the selectivity of the gear and the careful aim divers exercise to strike a fish, divers spearfishing are easily be able to avoid aiming in any direction where sea turtles or smalltooth sawfish are within their striking range. Any behavioral effects on sea turtles or smalltooth sawfish from the presence of divers fishing are expected to be insignificant.

Hook-and-line gear authorized in the Gulf reef fish fishery includes both bottom longline and vertical line (handline, electric reel, bandit gear, buoy gear, rod and reel). Section 2 describes how recreational and commercial fishermen use one or more of these gears to target reef fish. The type of fishing gear and the area and manner in which it is used both affect the likelihood and severity of listed species interactions, and risks vary by species. As a result, for our sea turtle gear analyses, the Gulf reef fish hook-and-line fishery is parsed into three fishery components: commercial bottom longline, commercial vertical line, and recreational vertical line. For smalltooth sawfish, our analyses of the effects of each fishery component were less complicated, and we had less information to differentiate them, so we combined them into one section (i.e., Section 5.4). For all of our analyses, we first reviewed the range of responses to an

[9] Traps were previously used in the fishery, but were prohibited in February 2007.

individual's exposure, and then the factors affecting the likelihood of its exposure. After that, our focus shifted to evaluating and quantifying the effects of the stressors, based on best available information.

New commercial bottom longline and vertical line observer data on sea turtle bycatch levels made it necessary to reanalyze the status quo effects of each fishery component on sea turtles instead of just relying on our take estimates in the previous opinion. Therefore, before considering the proposed action, we first estimated what the effects have been under the current management regime for the purpose of establishing baseline or status quo take impacts (i.e., the effects expected if the status quo were maintained and none of the proposed changes in Amendment 31 were implemented). We estimated the number of individuals of each species likely to be exposed, along with their estimated age or age class, and the likely fate of those animals. In determining the fate of incidentally caught sea turtles, we distinguished between immediate mortalities; animals that are captured and released, unharmed; and those animals that are captured and released, but later die as a result of the interaction. We then analyzed what effect, if any, implementation of the two proposed new rules would have on future interactions; i.e., whether the estimated past capture and mortality levels would increase or decrease and by how much, or whether the same levels would continue in the future.

Sections 5.1, 5.2, and 5.3 contain our analysis of the effects on sea turtles, and Section 5.4 contains our analysis of the effects on smalltooth sawfish. In Section 5.5, we analyze the potential effects of reef fish vessels on sea turtles and smalltooth sawfish. In the final part, Section 5.6, we provided a summary of the overall anticipated effects and calculate the anticipated level of all effects combined under the proposed action.

5.1. Commercial Bottom Longline Gear – Effects on Sea Turtles

5.1.1 Types of Interactions (Stressors and Individual Responses to Stressors)

Bottom longline gear is known to adversely affect sea turtles via hooking, entanglement, trailing line, and forced submergence. Captured sea turtles can be released alive or may be found dead upon retrieval of the gear as a result of forced submergence. Sea turtles released alive may later 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. Of the sea turtles hooked or entangled that do not die from their wounds, some may suffer impaired swimming or foraging abilities, altered migratory behavior, and altered breeding or reproductive patterns. The following discussion summarizes in greater detail the available information on how individual sea turtles are likely to respond to interactions with bottom longline gear.

Entanglement
Sea turtles are particularly prone to entanglement as a result of their body configuration and behavior. Fishing gear can drift according to oceanographic conditions, including wind and waves, surface and subsurface currents, etc.; therefore, depending on sea turtle behavior, environmental conditions, and set location, sea turtles can become entangled in fishing gear.

Records of stranded or entangled sea turtles reveal that hook-and-line gear wrap around the neck, and foreflippers most frequently, but can also wrap around the body of a sea turtle.

If sea turtles become entangled in monofilament the line can inflict serious wounds, including cuts, constriction, or bleeding anywhere on a sea turtle's body. In addition, entangling gear can interfere with a sea turtle's ability to swim or impair its feeding, breeding, or migration and can force the sea turtle to remain submerged, causing it to drown. The fishing line can also become tighter and more constricting as the sea turtle grows, cutting off blood flow and causing deep gashes, some severe enough to sever an appendage.

None of the sea turtles observed to date in the bottom longline component of the Gulf reef fish fishery were recorded as entangled; however, there were four observed sea turtles for which the entanglement field of the data collection form stated "unknown." Given that at least a few sea turtles have been observed entangled in bottom longline gear targeting sharks, entanglements in reef fish bottom longlines are certainly still possible, though perhaps relatively rare. Entanglement may be less common in reef fish bottom longline gear because the gear is heavier and more stationary relative to other hook-and-line gears; it may also be related to the sea turtle species caught (see *Hooking* discussion next).

Hooking

Sea turtles are injured and killed by being hooked. Hooking can occur as a result of a variety of scenarios, some of which depend on the 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, hooking may occur in the gastro-intestinal tract (E. Jacobson in Balazs et al. 1995).

Pelagic longline hooking data indicate entanglement and external foul hooking (usually in the front flipper, shoulder, or armpit) are the primary forms of interaction between leatherback sea turtles and longline gear, whereas internal hooking is much more prevalent in hard-shelled sea turtles, especially loggerheads. For loggerheads, almost all interactions with longlines result from taking the baited hook; only a very small percentage of loggerheads are entangled or foul-hooked externally. The bottom longline component of the Gulf reef fish fishery has historically used circle hooks and, since June 2008, has been required to use non-stainless steel circle hooks when using natural baits. Although loggerheads caught on J-hooks in the pelagic longline fishery most often swallow the hooks (67 percent of interactions in Watson et al. [2003]), the use of large circle hooks has been shown to significantly reduce the rate of hook ingestion by loggerheads, thus reducing the post-hooking mortality associated with the interactions. Additionally, circle hooks are designed so that they typically result in hooking of the lower jaw when bitten, and even smaller circle hooks that are swallowed are shaped such that they hook the esophageal or digestive tract with much lower frequency than J-hooks (Watson et al. 2003).

Sea 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 sea turtle's mouth, especially if the hooks have been deeply ingested. Because of a sea turtle's digestive structure, deeply ingested hooks are also very difficult to remove without seriously injuring the sea turtle. A sea turtle's esophagus is attached firmly to underlying tissue; therefore, if a sea turtle swallows a hook and tries to free itself or is hauled on board a vessel, the hook can pierce the sea turtle's esophagus or stomach and can pull organs from their connective tissue. These injuries can cause the sea turtle to bleed internally or can result in infections, both of which can kill the sea turtle.

If a hook does not lodge into, or pierce, a sea turtle's digestive organs, it can pass through to the sea turtle's colon or it can pass through the sea turtle entirely (E. Jacobson in Balazs et al. 1995; Aguilar et al. 1995) with little damage (Work 2000). For example, of 38 loggerheads deeply hooked by the Spanish Mediterranean longline fleet and subsequently held in captivity, 6 loggerheads expelled hooks after 53 to 285 days (average 118 days) (Aguilar et al. 1995). If a hook passes through a sea turtle's digestive tract without getting lodged, the hook probably has not harmed the sea turtle. Tissue necrosis that may have developed around the hook may also get passed along through the sea turtle as a foreign body (E. Jacobson in Balazs et al. 1995).

Trailing Line

Trailing line (i.e., line left on a sea 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 sea turtle and potentially slicing its appendages and affecting 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 sea turtle eventually, leading to impaired movement, constriction wounds, and potentially death.

Forcible Submergence

Sea turtles can be forcibly submerged by bottom longline gear. Forced submergence can occur when a sea turtle becomes entangled or caught on a hook on a line below the surface and is unable to reach the surface to breathe, as is most frequently the case with bottom longline gear (i.e., the line is too short and/or too heavy to be brought up to the surface by the swimming sea turtle).

Sea turtles that are forcibly submerged undergo respiratory and metabolic stress that can lead to severe disturbance of their acid-base balance (i.e., pH level of the blood). Most voluntary dives by sea turtles appear to be an aerobic metabolic process, showing little if any increases in blood lactate and only minor changes in acid-base status. In contrast, sea turtles that are stressed as a result of being forcibly submerged due to entanglement eventually consume all their oxygen stores. This oxygen consumption triggers anaerobic glycolysis, which can significantly alter their acid-base balance, sometimes leading to death (Lutcavage and Lutz 1997).

Numerous factors affect the survival rate of forcibly submerged sea turtles. It is likely that the rapidity and extent of the physiological changes that occur during forced submergence are functions of the intensity of struggling, as well as the length of submergence (Lutcavage and Lutz 1997). Other factors influencing the severity of effects from forced submergence include the size, activity level, and condition of the sea turtle; the ambient water temperature; and if multiple forced submergences have recently occurred. Larger sea turtles are capable of longer voluntary dives than small sea turtles, so juveniles may be more vulnerable to the stress from forced submergence. 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. Increased metabolic rates lead to faster consumption of oxygen stores, which triggers anaerobic glycolysis. Subsequently, the onset of impacts from forced submergence may occur more quickly during these months (Gregory et al. 1996). Sea turtles are probably more susceptible to lethal metabolic acidosis if they experience multiple forced submergence events in a short period. With each forced submergence event, lactate levels increase and require a long time (up to 20 hours) to recover to normal levels. Therefore, recurring submergence does not allow sea turtles sufficient time to process lactic acid loads (Lutcavage and Lutz 1997). Stabenau and Vietti (2003) illustrated that sea turtles given time to stabilize their acid-base balance after being forcibly submerged have a higher survival rate. The rate of acid-base stabilization 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., water temperature, wave action, etc.), and the nature of any injuries sustained at the time of submergence (NRC 1990). Disease factors and hormonal status may also influence survival during forced submergence. 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 (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 bottom longline or vertical line. Recapture would also depend on the condition of the sea turtle and the intensity of fishing pressure in the area. NMFS has no information on the likelihood of recapture of sea turtles by reef fish bottom longlines. However, sea turtles in the Atlantic Ocean have been captured more than once by pelagic longliners (on subsequent days), as observers reported clean hooks already in the jaw of captured sea turtles. Such multiple captures were thought to be most likely on three or four trips that had the highest number of interactions (Hoey 1998).

In the worst scenario, sea turtles will 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.

5.1.2 Potential Factors Affecting the Likelihood and Frequency of Sea Turtle Interactions with Bottom Longline Gear

A variety of factors may affect the likelihood and frequency of listed species interacting with reef fish bottom longline gear. The spatial and temporal overlap between fishing effort and sea turtle abundance and sea turtle behavior may be the most evident variable involved in anticipating interactions. Other fishing related-factors that may influence the likelihood and frequency of hooking, entanglement, and forced submergence effects include gear characteristics (e.g., hook sizes, bait) and fishing techniques employed (e.g., soak times). Each of these factors and its potential influence is discussed briefly below. Additional discussion and analyses of the potential effects bottom longline fishing practices and gear may have on sea turtle catch rates based on limited observer data is contained in Amendment 31; the Gulf Council spent considerable time trying to find ways to reduce sea turtle captures other than by reducing fishing effort.

Spatial/Temporal Overlap of Fishing Effort and Sea Turtles and Sea Turtle Behavior
The likelihood and rate of sea turtle hookings and/or entanglements in reef fish fishing gears is at least in part a function of the spatial and temporal overlap of sea turtle species and fishing effort. The more abundant sea turtles are in a given area where and when fishing occurs, and the more fishing effort in that given area, the greater the probability is that a sea turtle will interact with gear. Environmental conditions may play a large part in both where sea turtles are located in the Gulf and whether or not a sea turtle interacts with bottom longline gear.

Hook Type
The type of hook (size and shape) used in fisheries likely plays a role in the probability and severity of interactions with sea turtles. Experiments in pelagic longline fisheries demonstrate the best hook type for avoiding sea turtle takes is the circle hook. The configuration of a circle hook reduces the likelihood of foul-hooking interactions because the point of the hook is less likely to accidentally become embedded in a sea turtle's appendage or shell. In some fisheries, circle hooks are wide enough to actually prevent hooking of some sea turtles if the sea turtle cannot get its mouth around the hook (Gilman et al. 2006). Circle hook configuration also reduces the severity of interactions with sea turtles because the design has a tendency to hook in the animal's mouth instead of its pharynx, esophagus, or stomach (Prince et al. 2002, Skomal et al. 2002).

The bottom longline component of the Gulf reef fish fishery has historically used and is now required to use circle hooks. Foul-hooking events have been rare; of the 27 observed takes in the bottom longline component of the reef fish fishery, there are only 3 observed foul hookings (all in front flippers). Because the bottom longline component of the Gulf reef fish fishery uses relatively small circle hooks compared to pelagic longline fisheries and catches much larger sea turtles than pelagic longline fisheries, we suspect circle hooks width do not prevent any hookings (i.e., any sea turtle encountered could get its mouth around the hook). However, as suspected with circle hooks, all of the other hooking locations observed to date were in the beak (most common), mouth (roof or side) or jaw joint; none were observed hooked in the pharynx, esophagus, or stomach (NMFS-SEFSC 2008, 2009a; SEFSC observer database, unpublished data).

Bait

Sea turtles may be attracted to and bite baited hooks, particularly loggerhead sea turtles. Cut pieces of squid and finfish are typically used as bait in the bottom longline component of the Gulf reef fish fishery. When observers documented sea turtle takes and recorded bait type, 38 percent of the bait was identified as squid, 19 percent finfish, and 43 percent of the bait type was unknown (NMFS-SEFSC 2008, 2009a).

Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hardbottom habitats. Kemp's ridley sea turtles also feed on these species. Therefore, loggerhead and Kemp's ridley sea turtles are likely the species attracted to gear baited with these prey items. Green, hawksbill, and leatherback turtles may still also be attracted to fishing bait and have been caught on fishing hooks, but their feeding habits make it less likely. Green sea turtles become herbivorous as they mature, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan 1988). Leatherbacks feed primarily on cnidarians (medusae, siphonophores) and tunicates so are less likely to be attracted to bottom longline gear bait, which typically consists of squid and finfish.

Bait characteristics (e.g., the type, size, and texture of the bait) may also influence the likelihood and frequency of certain sea turtle species becoming incidentally hooked. For example, in pelagic longline fisheries, there has been considerable success in reducing leatherback sea turtle takes by modifying bait usage, particularly replacing squid baits with mackerel (Watson et al. 2005). There are laboratory studies on the effect different bait characteristics have on loggerhead sea turtles' feeding behavior and preferences (Kiyota et al. 2004, Stokes et al. 2006). Because of significant differences between the pelagic longline and bottom longline fisheries in the sizes of the sea turtles (i.e., small versus large), the sizes of hooks (i.e., large versus small), and the baits (i.e., whole versus cut), we do not believe the results of these studies are applicable to reef fish bottom longlines without further study in the ref fish fishery.

Soak Time/Number of Hooks/Mainline Length

Bottom longline gear interactions with sea turtles may be affected by both soak time and the number of hooks fished, independent of overall fishing effort. In longlining, each hook is in the water for the period of time required to set the remaining hooks, the time to haul the previously set hooks, and additional time while the longline vessel steams back to the beginning of its set and waits. The longer the soak time, the greater the chances a foraging turtle may encounter the gear and the longer a sea turtle may be exposed to the entanglement or hooking threat, presumably increasing the likelihood of such an event occurring. Likewise, as the number of hooks in the water in a given area increases, so may the likelihood of an incidental hooking event. It is probable that the more hooks used per mainline, and the longer the mainline, the greater the soak time will be, simply due to the amount of time it takes to haul back gear (i.e., retrieval of the mainline, dehooking catch, and dehooking bycatch). Thus, the two factors may interact to increase the risk of turtle encounters.

As discussed in NMFS SEFSC (2008), our bycatch estimates are derived from a CPUE and logbook-reported effort based on the number of hooks set. So turtle bycatch is explicitly assumed to vary directly with changes (increases or decreases) in the total number of hooks set in a stratum. Although we believe it is reasonably likely that set duration also affects bycatch rates, that relationship is not demonstrated or quantified for the bottom longline component of the Gulf reef fish fishery.

Gangion Length
As discussed in Amendment 31, some reef fish bottom longline fishermen have suggested that longer gangions allow the bait to float up off the bottom, so that the sea turtle is not aware of the gangion and hook attached to the mainline, resulting in the sea turtle either becoming hooked while eating the bait or entangled while pursuing the bait. Anecdotal evidence also suggests that use of longer gangions lends itself to different fishing practices such as longer soak times. However, fishermen's reports are conflicting, and observer data, albeit limited, indicates sea turtles have been caught on all gangion lengths (GMFMC 2009). Further research would be needed to determine if there is a significant correlation between gangion length and sea turtle takes.

5.1.3 Estimating Past Sea Turtle Captures and Mortalities in the Bottom Longline Component of the Gulf Reef Fish Fishery

In NMFS (2005a), we presented the first quantitative assessment of the effects of the bottom longline component of the Gulf reef fish fishery on sea turtle species, based on the best available information at that time. Data reviewed for sea turtle bycatch records included a 1994 and 1995 SEFSC observer study, August 2001 through July 2004 supplementary discard program (SDDP) data (self-reported sea turtle bycatch logbook records), a 2004 cooperative observer project, and then-recent anecdotal reports. Although the old SEFSC observer study did not reveal any sea turtle bycatch, the SDDP and cooperative observer project information clearly demonstrated that Gulf reef fish commercial bottom longline gear had caught sea turtles in recent years. We concluded sea turtles had likely always been occasionally caught by bottom longlines targeting reef fish as first predicted (e.g., NMFS 1989a), but that too few trips had been observed by the SEFSC to detect such infrequent events. Based on the logbook bycatch and effort data, we estimated that between July 2001 and August 2004 there were 114 sea turtles (1 leatherback, 2 Kemp's ridley, 26 green, and 85 loggerhead sea turtles) captured by the longline component of the reef fish fishery. Of those captures, we estimated 57 resulted in mortalities (1 leatherback, 1 Kemp's ridley, 13 green, and 42 loggerhead sea turtles). The same numbers of captures and mortalities were anticipated to persist triennially with the continued authorization of that component of the fishery.

The SDDP remained the only data source available for monitoring sea turtle captures on reef fish bottom longlines until January 2006. A NMFS grant-funded observer project was originally set to begin in June 2005, but was postponed until January 2006 because of an early projected closure of the grouper fishery that year; the project was then conducted only through July 2006 because of permit extension issues. In July 2006, the SEFSC started observing sets targeting reef fish via the RFOP and the SBLOP. As discussed in Section 2.1.2, the RFOP and SBLOP are on-going programs; each program was independently designed and implemented sampling regimes for different, but overlapping portions of the Gulf commercial reef fish fishery, and both used random sampling in an attempt to achieve a representative sample of the fishery. In 2008, the RFOP also administered a voluntary reef fish electronic monitoring (RFEM) project. The RFEM was not part of the normal operation of a mandatory observer program; instead it was based on solicitation of volunteers. Five of the six volunteer vessels came from a single port (the other a nearby port), and all observations occurred between mid-March and early May.

In conducting this consultation, in addition to reviewing the new SEFSC observer data, we reviewed and considered all other known data sets containing reef fish bottom longline sea turtle bycatch data. We revisited the data sets reviewed in NMFS (2005a) and incorporated new data as available; we also searched for other new or potentially overlooked data sources. Data sources considered included: Gulf and South Atlantic Fisheries Foundation/University of Florida Commercial Shark Fishery Observer Program (1994-2005), SEFSC Historic Reef-Fish Observer Program (1994-95), SEFSC Bottom Longline Surveys from the Eastern U.S. Gulf of Mexico (2000-2008), Supplementary Discard Data Program (2001-Present), Mote Marine Laboratory Longline Sampling Observer Data (November 2000-October 2005), and a NMFS MARFIN Grant Observer Study (January-June 2006).

Data from the new SEFSC observer programs indicate that sea turtle capture and mortality rates in reef fish bottom longlines are significantly higher than anticipated or documented via the SDDP. Collectively comparing both old and new data, because of differences in sampling metrics and time frames, etc., it cannot be determined whether or not or to what extent past captures in reef fish bottom longlines were underestimated or have increased, fluctuated, or both over the last ten years since the fishery was observed. Some fishermen have indicated that sea turtle bycatch is a relatively new problem in this fishery and is associated with the introduction of longer gangions, but there are no data to substantiate that longer gangions have a higher sea turtle catch rate. Other fishermen have indicated that sea turtle catch rates have not changed over time. It is interesting to note that the January to June 2006 NMFS MARFIN grant observer project documented similar capture rates to those NMFS (2008) documented with July 2006 through 2007 observer data, despite having observed 50 percent fewer sets (see Appendix 3). This is somewhat surprising, considering the large confidence intervals associated with these take estimates.

The new SEFSC observer data represent the best available information at this time on which to estimate recent sea turtle bycatch levels in reef fish bottom longlines. Bycatch data reported in logbooks can be useful in estimating bycatch, but only if fishermen are willing and able to report bycatch accurately in the logbooks. If fishermen perceive that accurate reporting of bycatch will result in restricted fishing effort, they have incentive to under report bycatch. Since NMFS (2005a) was completed, SDDP participants have reported only two sea turtles caught on bottom longlines. Given the number of observed sea turtle captures relative to the number of self-reported sea turtle captures during the same time frame, it is likely the decrease in reported captures over the last several years reflects a decrease in reporting compliance. A NMFS national working group on bycatch reviewed regional issues related to fisheries and bycatch and discussed advantages and disadvantages of various methods for estimating bycatch, including fishery-independent surveys, self-reporting through logbooks, port sampling, recreational sampling, at-sea observation including observers, digital video cameras, digital observers, remote monitoring, and stranding networks. The national working group concluded that, although all methods may contribute to useful bycatch estimation programs, at-sea observation (observers or electronic monitoring) provides the best mechanism to obtain reliable and accurate bycatch estimates for many fisheries (NMFS 2004d). Logbooks were noted as more useful in providing estimates of total effort by area and season, which then can be combined with observer data to estimate total bycatch (NMFS 2004d).

Because we determined the new SEFSC observer data represent the best available data source on which to estimate the impacts of the fishery, the information presented in this section focuses on that data. In the following sections we provide summary information on the SEFSC observer data and recent SEFSC bycatch estimates presented in NMFS SEFSC (2008) and NMFS SEFSC (2009a). We then describe how we used the data presented in these reports in conjunction with other information to apportion unidentified sea turtles and sea turtles which were released in unknown conditions and to estimate total captures and mortalities by species. More detailed discussion of the data sources, calculation methods, constraints of those methods, and the assumptions under which those calculations were made are included in NMFS SEFSC (2008) and NMFS SEFSC (2009a). Appendix 3 provides summary information on the other considered data sources not discussed below.

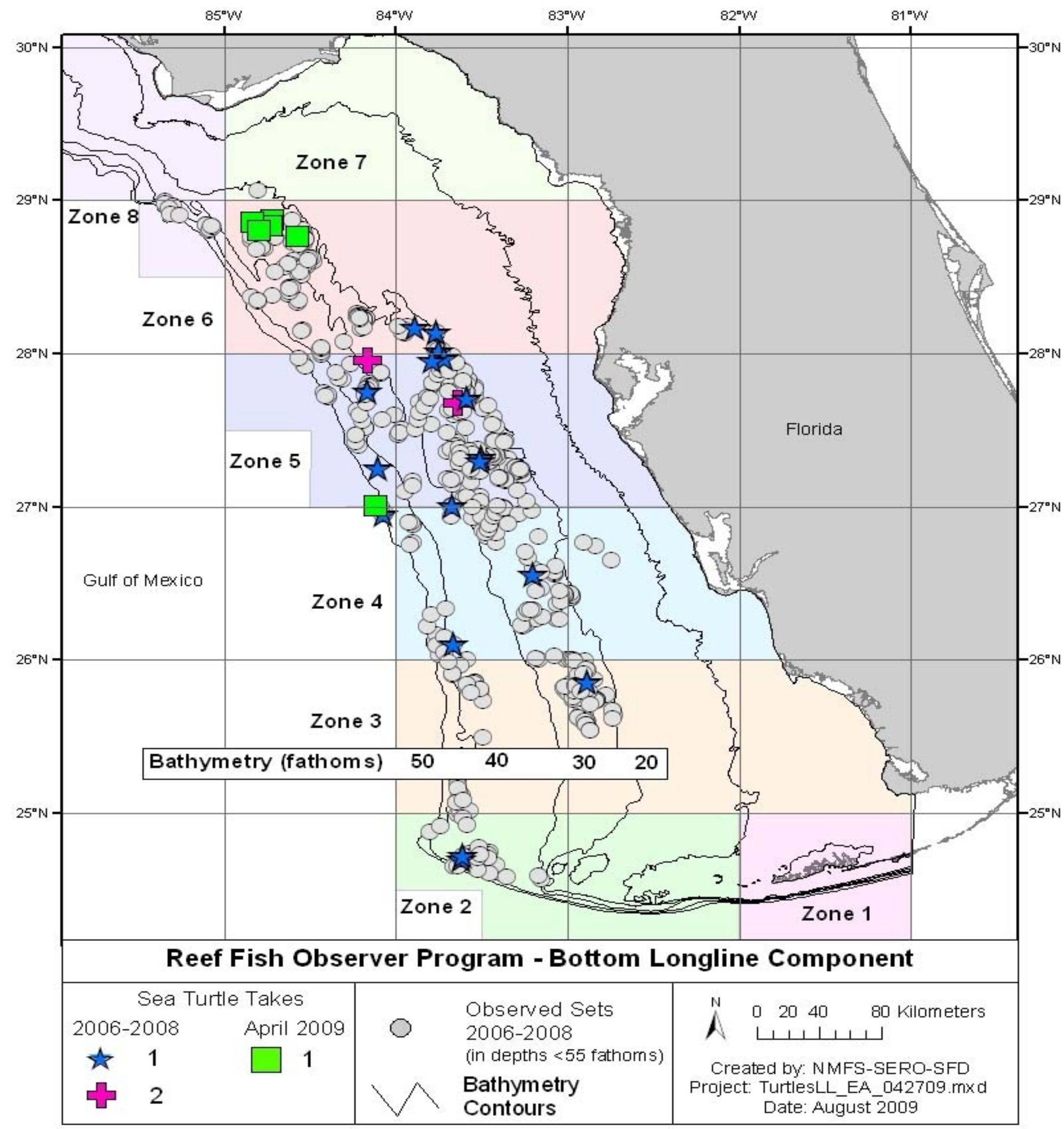
5.1.3.1 Observer Data Summary

From July 2006-December 2008, the SEFSC observed 42 bottom longline trips in the Gulf reef fish fishery which captured 21 sea turtles (18 loggerhead sea turtles and 3 unidentified hardshell sea turtles). In 2009, the RFOP observed 6 additional loggerhead sea turtle captures, 5 of which were observed during one trip in April.

Observers measured the size (i.e., curved carapace length [cm]) of 12 of the 27 sea turtles captured. Based on the life stage definitions in TEWG (2009), 1 of the measured sea turtles was an adult, and the rest were benthic juveniles. There were also 8 sea turtle captures for which observers recorded estimated sizes (i.e., carapace length in feet); all of these were adults or possibly-adult-sized. In summary, 9 out of the 20 (i.e., 45 percent) sea turtles estimated or measured were considered to be adults.

Figure 5.1 (next page) illustrates the locations of all observed captures of loggerhead and unidentified hardshell sea turtles in the bottom longline component of the Gulf reef fish fishery to date. All of the captures were in the Eastern Gulf; this is also where the vast majority of bottom longline fishing effort, and thus observed sets, occurred. In 2006 and 2007 there were no observed sets in the Western Gulf, and in 2008, there were only 88 sets, so one could argue that the lack of observed sea turtle takes in that region is solely an artifact of our observer coverage. However, sea turtle abundance is generally lower in the Western Gulf than the Eastern Gulf. Also, regulations prohibit longlines in waters less than 50 fathoms west of Cape San Blas. Therefore, we believe that turtle catch rates are likely much lower in the Western Gulf than the Eastern Gulf.

Figure 5.1 Observed Captures in the Bottom longline Component of the Gulf Reef Fish Fishery



5.1.3.2 Estimating Total Sea Turtle Capture Levels

In September 2008, NMFS released a report that estimated the total number of sea turtle captures in the bottom longline component of the Gulf reef fish fishery for the period July 2006 through 2007 (NMFS SEFSC 2008). During that period, 18 sea turtle captures were observed by the RFOP and SBOP on bottom longline gear targeting reef fish in the Eastern Gulf, 16 of which were identified as loggerhead sea turtles and 2 of which were only identified as hardshell (i.e., not leatherback) sea turtles.

NMFS SEFSC (2008) estimated total sea turtle captures based on catch per hook derived from samples of commercial vessels using bottom longline gear and targeting reef fish (i.e., RFOP and SBLOP data), extrapolated to total self-reported hook effort derived from logbook data. Analyses were stratified to approximate observer program designs by season (January 1 through June 31and July 1 through December 31) and by area (Eastern Gulf [east of 88°W longitude] and Western Gulf [west of 88°W longitude]). The delta lognormal approach was used to estimate the mean and variance of captures per hook per observed strata. Extrapolated captures were the multiplication of catch per hook by the total number of hooks from the logbook that were estimated to be targeting reef fish. It was assumed that effort was targeting reef fish if the fishermen reported using bottom longline gear and were not in possession of a directed shark permit or, if they were in possession of a directed shark permit, then if they had landings greater than two-thirds by weight of species other than sharks. NMFS SEFSC (2008) included separate capture estimates by strata for those sea turtles identified positively as loggerheads and for hardshell (i.e., loggerhead sea turtles plus unidentified hardshell) sea turtles. Extrapolating the 2006-2007 sea turtle captures to the Eastern Gulf using the logbook data, the number of confirmed loggerhead and hardshell sea turtle captures was estimated to be 732 (95% confidence interval (C.I.) 310-1,728, coefficient of variance (CV) 0.46) and 902 (95% CI 411-1,983), respectively, for the 18-month time period (NMFS SEFSC 2008). Extrapolating the 2006-2007 captures to the entire Gulf, NMFS SEFSC (2008) estimated 800 loggerhead sea turtles (339-1,884, CV .42) and 974 hardshell sea turtles (95% C.I. 444.1-2,137, CV 0.42) were caught over that 18-month time period.

In April 2009, the SEFSC released an update to NMFS SEFSC (2008) to incorporate revised 2006 and 2007 observer and effort data and new 2008 observer and effort data. The logbook effort revisions resulted from a slight decrease in 2006 effort associated with quality controls and editing of the database and an increase in effort in 2007 due to additional logbooks being sent to the SEFSC. There was also an increase in observer effort in 2006 and 2007 from the prior report because of additional trips being archived in the database. The new 2008 observer data indicated three sea turtles captures (two loggerhead sea turtles and one unidentified hardshell sea turtle) were observed on reef fish bottom longlines in 2008 on RFEM trips; no sea turtle captures were recorded in the RFOP or the SBLOP.

The updated report (i.e., NMFS SEFSC 2009a) estimated sea turtles captures in the bottom longline component of the Gulf reef fish fishery based on the revised and new data. For the period July 2006 through 2008, NMFS SEFSC (2009a) estimated 861 hardshell sea turtles (95% C.I. 463-2,019) were caught in the Eastern Gulf. The estimated total and stratified sea turtle captures were based on catch per hook derived from assumed representative samples from the RFOP and the SBLOP of commercial vessels using bottom longline gear, extrapolated to total reported hook effort. Captures documented in the RFOP and SBLOP were extrapolated using the same analysis methods described in NMFS SEFSC (2008) and summarized above, with one exception. The Western Gulf was treated as a separate sample and assumed no captures in the western Gulf based on no Western Gulf observations (see Tables 5 in 6 in NMFS SEFSC 2009a). The sea turtle captures in the RFEM were not extrapolated because the RFEM was deemed not a representative sample; instead, they were added to the estimated captures from the randomly sampled portion.

Annual capture estimates for the same fishery component can vary considerably due to observed annual variation in captures and variation in the data itself. Observed annual variation and overall capture estimates may reflect variation in actual annual captures or be an artifact of observer coverage levels. The 2006-2008 estimates of sea turtle captures were less than the 2006/2007 estimates because there were no captures observed by the RFOP or the SBLOP in 2008. SEFSC (2009) noted that the lack of observed takes in the RFOP and SBLOP in 2008 was based on a very low observed sample size. For example, compared to 2007, the RFOP had observer coverage reduced by 50 percent and the SBLOP was reduced by 20 percent.

SEFSC (2009) indicated that if the RFEM was treated as a representative sample, and its data used with RFOP and SBLOP data to extrapolate to the total fishery effort; the overall estimated take for all hardshell sea turtles during the period from July 2006 though 2008 (30-month period) would increase to 967.1 (95 percent C.I. 463.1-2,019.9). However, this estimate was still likely biased low because the RFEM all occurred in season 1 of 2008 (e.g., 2008-S1); 2008-S2 sampling was insufficient to have a reasonable likelihood of observing any takes.

For the purposes of this opinion, we are taking a conservative but reasonable approach and estimating past take levels by using all observer data sources (i.e., RFOP, SBLOP, and RFEM) but only from 2006 through 2008-S1 as representative of past take levels in the entire Gulf action area. We are not using the 2006 to 2008 (combined) estimates in the NMFS SEFSC (2009a) because it is our opinion that these underestimate bycatch levels for several reasons. First, by not including the 2008- 1 RFEM data in its extrapolation, it is assumed the three sea turtle captures observed during RFEM were the only captures that season and that year in the bottom longline component of the Gulf reef fish fishery. This is highly unlikely to be a valid assumption given observed levels and is a much more risky assumption than treating the RFEM as representative data. By extrapolating RFEM observed captures, we are electing to treat the RFEM as a representative sample. This elevated the number of observed sets in 2008-S1 from 111 (96 SBLOP sets and 15 RFOP sets) to 356 sets (96 sets in the SBLOP, 15 sets in the RFOP, and 260 sets in the RFEM) and raised observer coverage for the Eastern Gulf in 2008-S1 to 1.38 percent of trips, more akin to coverage obtained in other seasons. Although RFEM vessels did volunteer and were from nearby ports (i.e., five vessels from Cortez; one vessel from Ruskin), our review of observed set characteristics revealed no unique gear or fishing behavior characteristics that to our knowledge would bias their sea turtle catch rates compared to other vessels. Thus, we believe inclusion of these data improve our estimate. Second, there was inadequate observer coverage in 2008-S2, to conclude no takes occurred in the Eastern Gulf that season, and no other observer data were available to use instead. Observed sets that season were significantly lower than all other seasons (i.e., only 65 set observed in RFOP and SBLOP combined, compared to 228, 154, and 218 sets in RFOP and SBLOP combined in 2006-S 2, 2007-S1, and 2007-S2 respectively). Third, NMFS SEFSC (2009a) only included an estimate for the entire Gulf based on summation of separate Eastern and Western Gulf estimates. Considering only 81 sets were observed in the Western Gulf over the entire 30-month time period, observer coverage in the Western Gulf was too sparse to conclude no takes occurred in the entire fishery.

In order to produce an annual estimate of captures over the last three years, based only on July 2006 through 2008, season 1, observer data, several calculations were necessary. To account for revisions to 2006 and 2007 data and our incorporation of the RFEM, we first had to recalculate Eastern Gulf weighted estimates using the data from NMFS SEFSC (2009a). Weightings were determined by the proportion of sets allocated to the respective portions of the total effort that were sampled by each observer program. To provide an estimate for the entire Gulf action area, we looked back at what proportion the Western Gulf was of the entire Gulf estimate provided in NMFS SEFSC (2008) (i.e., 7.4 percent) and then used that proportion to adjust our Eastern Gulf estimate to represent the entire Gulf. Although the proportion was not corrected for revisions to the 2006 and 2007 data, it is expected to have had little effect on our estimate.

In conclusion, based on our calculations, we estimate 519 hardshell sea turtles were caught annually under status quo management of the Gulf reef fishery. Although we could not calculate confidence intervals for this estimate, we assume it reflects confidence intervals similar in magnitude to those reported in NMFS SEFSC (2008) and NMFS SEFSC (2009a).

5.1.3.3 Estimating Sea Turtle Captures By Species

In addition to determining the total number of sea turtles captured in reef fish bottom longlines as a result of the proposed action, we must also estimate the number of captures by species. In the previous section, we estimated 519 hardshell sea turtles were captured annually based on observed loggerhead sea turtles and unknown hardshell sea turtles combined; we did not partition our estimate by species. Therefore, in this section we consider how those captured were distributed by species.

In NMFS (2005a), we estimated all sea turtle species, except hawksbill sea turtles, would be captured on reef fish bottom longlines. Estimated hardshell sea turtle captures were apportioned by species in several steps. First, we multiplied the total capture estimates for each gear type by sea turtle relative abundance estimates published in Epperly et al. (2002) based on the proportional distribution of reef fish fishing effort in each stratum. In doing so, we assumed that the probability of catching any hardshell sea turtle species was equal through time and space and solely a function of their relative abundance in the action area. Second, we considered whether differences in sea turtle behavior, sea turtle distributions (i.e., site/habitat-specific distributions), and fishing effort distribution would result in certain species being more likely to be caught than others and bias our results. Based primarily on our knowledge of the abundance and distribution of hawksbill sea turtles and no hawksbill capture records in other bottom longline fisheries, we determined hawksbill sea turtle captures were highly unlikely. Therefore, in the final step of our analysis, we adjusted Epperly et al.'s (2002) relative abundance estimate for hawksbills to zero and recalculated the relative abundance estimates for loggerheads, Kemp's ridleys, and greens to reflect this change (see Section 5.3.3.1 of NMFS (2005a) for more detailed explanation). This resulted in total bottom longline captures being allocated as 75 percent loggerhead, 23 percent green, and 2 percent Kemp's ridley sea turtles. We also estimated one leatherback sea turtle would be captured, despite none reported via the SDDP, because we thought our sample size was too small to rule out any leatherback sea turtle captures, given their presence in the action area and their rare capture in other bottom longline fisheries.

We now have observer data for the bottom longline component of the Gulf reef fish fishery, which support loggerhead sea turtles are the most frequently captured species. In fact, of the 27 sea turtles observed in the fishery to date, 23 (i.e., 85 percent) were identified as loggerhead sea turtles, and the remaining 4 (15 percent) were identified only as unknown hardshell sea turtles. Based on observed captures, we believe observed unknown sea turtles were most likely to have also been loggerhead sea turtles. NMFS SEFSC (2009a) explains that "unknown hardshell" recorded entries was used by observers when they did not get a chance to identify the sea turtle, except a glimpse to identify them as hardshell, and not because they were unidentifiable because, for example, it was a rare species the observer was not familiar with.

Given this new information, we believe it is more appropriate to assume all extrapolated observed hardshell sea turtles (i.e., loggerhead plus unidentified sea turtles) were loggerhead sea turtles than to apply our previous approach and risk underestimating the impact the bottom longline component of the Gulf reef fish fishery has on loggerhead sea turtles. In determining how to apportion total captures, we considered the benefits versus risks of alternative decisions to each species. Ultimately, we decided it was most conservation-minded to risk overestimating the proportion of unidentified hardshell sea turtle captures that are loggerhead sea turtles, given recent loggerhead nesting declines and much greater capture magnitude likelihood based on observed identified captures. Although total population sizes of the other sea turtle species in the action area are smaller, unlike loggerhead sea turtles, these other sea turtles species are exhibiting increasing nesting trends; thus, any small numbers of undetected individuals would be of less concern for our jeopardy conclusions for these species, than for loggerheads.

In addition to the estimated 519 loggerhead sea turtles annual captures under the status quo, we estimate 1 green, 1 hawksbill, 1 Kemp's ridley, and 1 leatherback sea turtle were also captured annually. Based on our knowledge of the preferred habitats and feeding behaviors of other hardshell species and no observed capture records in other bottom longline fisheries (i.e., the HMS shark fishery), we believe non-loggerhead captures have been exceedingly rare. However, in light of the low observer coverage levels on reef fish bottom longlines and the presence of other sea turtle species in the action area it is possible, although not probable, that one or more of the sea turtles identified only as a hardshell sea turtle was a different hardshell sea turtle species or that one or more different hardshell or leatherback sea turtles were captured in the past, but at levels too low to be detected by observer programs. Thus, with a total bycatch sample size of 27 observed sea turtles, we cannot rule out that not even a single individual of another species was caught on this gear annually.

5.1.3.4 Estimating Mortality (Immediate and Post-Release)

To better understand the effect the Gulf reef fish fishery has had on each sea turtles species, it is necessary to also estimate the mortality associated with estimated captures. As discussed in 5.1.1, sea turtle mortality can occur prior to release (i.e., immediate mortality) or later in time, when individuals released alive die later from related injuries (i.e., post-release mortality). Both types of mortality are reviewed and estimated below for sea turtles caught on reef fish bottom longlines and then overall mortality calculated.

Bottom Longline At-Vessel Mortality (Immediate Mortality)
In our last opinion, we estimated 27 percent immediate mortality based on the reported disposition of individuals captured in reef fish bottom longlines and evidence of similar immediate mortality rates observed in the bottom longline component of the HMS shark fishery. Observer data now indicate immediate mortality has been greater than anticipated. Of the 27 sea turtles observed captured on bottom longlines, 13 were released alive, 10 were released dead, and the release conditions of the remaining 4 were unknown. Based on the percent of sea turtle captures observed dead out of the total observed captures with known release conditions and assuming the unknowns had the same alive/dead ratio, we estimated 43.5 percent of sea turtle captures on bottom longlines targeting Gulf reef fish were released dead (i.e.,10/23*100=43.5%), Although we could have made the "worst-case" assumption that they were all dead, we believe this approach is more reasonable, but still sufficiently conservative.

Post-release mortality
Although neither SEFSC (2008) nor SEFSC (2009b) attempted to estimate post-release mortality, at least some portion of the sea turtles released alive may ultimately succumb to the injuries they sustained at capture. Most, if not all sea turtles released alive from bottom longline gear will have experienced a physiological injury from forced submergence and/or traumatic injury from hooking and entanglement, and many may still carry penetrating or entangling gear.

In January 2004, NMFS convened a workshop of experts in the areas of sea turtle biology, sea turtle anatomy/physiology, sea turtle veterinary medicine, sea turtle satellite telemetry, and longline gear deployment to develop criteria for estimating post-release mortality of sea turtles subject to pelagic longline fishery interactions with sea turtles. Criteria were based on the best available information on the subject, to set standard guidelines for assessing post-release mortality. In 2006, those criteria were revised and finalized (Ryder et al. 2006). The final criteria are presented in Table 5.1 (see next page). Under the new criteria, overall mortality ratios are dependent upon the type of interaction (i.e., hooking, entanglement, etc.) and the amount/type of gear remaining on the animal at the time of release (i.e., hook remaining, amount of line remaining, entangled or not). Therefore, the experience, ability, and willingness of the crew to remove the gear, and the availability of gear-removal equipment are very important factors influencing post-release mortality. The new criteria also take into account differences in post-release mortality between hardshell sea turtles and leatherback sea turtles, with slightly higher rates of post-release mortality assigned to leatherbacks.

In NMFS (2005a), we used the draft criteria to estimate post-release mortality associated with reef fish gear. We did not have empirical data describing sea turtle interaction types and sea turtle release conditions for the Gulf reef fish fishery. Following the guidance provided in Epperly and Boggs (2004), captures were included in the most conservative likely post-release category, based on what we knew about the fishery's gear and general operation. Given the reef fish fishery's use of circle hooks and anecdotal information indicating fishers typically just cut the line when sea turtles are caught, we assumed sea turtles would be hooked in the jaw and released still hooked and with trailing line. Based on these assumed conditions and the January 2004 post-release criteria, post-release mortality was estimated to be 30 percent for hardshell sea turtles released alive and 40 percent for leatherbacks.

For loggerhead sea turtles, this time we were able to apply the post-release mortality criteria and associated mortality ratios presented in Ryder et al. (2006) directly to the empirical data collected on final disposition of observed hardshell sea turtle live captures. We reviewed the individual observer reports of each sea turtle released alive to determine the type of injury it had received, using the criteria in Table 5.1. We then applied the corresponding post-release mortality percentages to determine the number of animals with observer reports that likely died of their injuries following their release. Interestingly, this method resulted in an approximately 30 percent average post-release mortality, like we had previously estimated.

Our estimated captures of the other sea turtle species (i.e., one green, one hawksbill, one Kemp's ridley, and one leatherback sea turtle) were not based on empirical data on release disposition; the fate of these animals is estimated in our summary of overall mortality below.

Overall Mortality

Combining an immediate mortality of 43.5 percent with a 30 percent post-release morality on the remaining sea turtles yields a 60.5 percent overall estimated mortality for loggerhead sea turtles captured on reef fish bottom longlines (i.e., (100% - 43.5%)*0.30+43.5%). Therefore, of our estimated 519 loggerheads caught annually, 314 (519 takes x 0.605) resulted in mortality. Based on our summary of the types of interactions that result from bottom longline interactions, we conservatively estimated the 1 green, 1 hawksbill, 1 Kemp's ridley, and 1 leatherback sea turtle captures were all lethal.

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Table 5.1 Criteria for assessing marine turtle post-interaction mortality after release from pelagic longline gear. Percentage rates of mortality are shown for hardshell turtles, followed by percentages for leatherbacks (in parentheses).

Injury Category		Release Condition			
		Released with hook and with trailing line greater than or equal to half the length of the carapace (line is trailing, turtle is not entangled)	**Released with hook and with trailing line less than half the length of the carapace (line is trailing, turtle is not entangled)**	**Released with hook and entangled (line is not trailing, turtle is entangled)[1]**	**Released with all gear removed**
		Hardshell (Leatherback)	Hardshell (Leatherback)	Hardshell (Leatherback)	Hardshell (Leatherback)
I	Hooked externally with or without entanglement.	20 (30)	10 (15)	55 (65)	5 (10)
II	Hooked in upper or lower jaw with or without entanglement. Includes ramphotheca, but not any other jaw/mouth tissue parts (see Category III).	30 (40)	20 (30)	65 (75)	10 (15)
III	Hooked in cervical esophagus, glottis, jaw joint, soft palate, tongue, and/or other jaw/mouth tissue parts not categorized elsewhere, with or without entanglement. Includes all events where the insertion point of the hook is visible when viewed through the mouth.	45 (55)	35 (45)	75 (85)	25 (35)
IV	Hooked in esophagus at or below level of the heart with or without entanglement. Includes all events where the insertion point of the hook is not visible when viewed through the mouth.	60 (70)	50 (60)	85 (95)	n/a[2]
V	Entangled only, no hook involved.	Released Entangled 50 (60)			Fully Disentangled 1 (2)
VI	Comatose/resuscitated.	n/a [3]	70 (80)	n/a [3]	60 (70)

[1] Length of line is not relevant as turtle remains entangled at release.
[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.
[3] Assumes that a resuscitated turtle will always have the line cut to a length less than half the length of the carapace, even if the hook remains.

5.1.4 Extent of the Effects – Anticipated Effects on Sea Turtles under the Proposed Action

In the preceding subsections, we re-analyzed the effects of Gulf reef fish bottom longlines on sea turtles (i.e., the number captures and associated mortalities) under existing management through 2008, based on updated information not available to us during our last consultation. With that analysis completed, we now address what effect the bottom longline component of the Gulf reef fish fishery would have on future sea turtle captures and mortality levels under the proposed action. The analyses in this section are directed only at loggerhead sea turtles. This is because we estimated that they comprise the vast majority of sea turtle bycatch in reef fish bottom longlines and as such, are expected to be impacted by the proposed rulemakings. We do not anticipate the proposed action will have a detectable effect on the other listed sea turtles because their capture is too rare to be affected in a uniform way.

As presented in Section 2, two new rulemakings are proposed: one to support the continued operation of the bottom longline component of the Gulf reef fish fishery while maintaining adequate protection for loggerhead sea turtles until Amendment 31 would be effective, and one to implement the suite of preferred alternatives in Amendment 31. The two proposed rulemakings, if implemented, would place new restrictions on the bottom longline component of the Gulf reef fish fishery, and are specifically intended to reduce sea turtle bycatch. The first rulemaking would: (1) prohibit the use of bottom longline gear in the reef fish fishery east of Cape San Blas, Florida, inshore of the 35-fathom contour and (2) restrict the number of hooks that may be possessed onboard each vessel to 1,000 hooks total, only 750 of which may be rigged for fishing. The second rulemaking would (1) prohibit the use of bottom longline gear in the reef fish fishery east of Cape San Blas, Florida, inshore of the 35-fathom contour from June through August; (2) reduce the number of bottom longline vessels operating in the fishery through a longline endorsement provided only to vessel permits with a demonstrated history of landings, on average, of 40,000 pounds of reef fish annually with fish traps or longline gear during 1999-2007; and (3) restrict the number of hooks that may be possessed onboard each vessel to 1,000 hooks total, only 750 of which may be rigged for fishing. The first rulemaking was initially anticipated to be effective October 1, 2009, through March 31, 2010, and the second rulemaking anticipated to be effective starting April 1, 2010. The proposed rulemaking are now expected to be effective by October 1 and April 1, respectively.

Stated simply, sea turtle bycatch estimates in fisheries are essentially calculated by multiplying a sea turtle bycatch rate (i.e., sea turtle bycatch per unit effort) by total fishing effort. Thus, changes in sea turtle bycatch rates, total effort (i.e., hooks), or both, would also result in changes to the estimated number of captures.

NMFS SERO (2009) and a September 17, 2009, Memorandum from F/SER2 to F/SER3 collectively analyzed the anticipated effects of the proposed rulemakings by evaluating changes in "effective effort" impacting sea turtle captures in the bottom longline component of the Gulf reef fish fishery under various assumptions based on the best available information. Effective effort was treated as the number of hooks as reduced by scalar reduction in sea turtle bycatch rate following redistribution of effort from 20-35 fathoms to deeper water during season closures. Reductions in total effort were assumed to result in an equivalent reduction in sea turtle takes as fewer vessels would remain making fewer trips or hooks, and hence, fewer turtle interactions.

This is a common assumption in sea turtle bycatch studies (Johnson et al. 1999, Richards 2006, Walsh and Garrison 2006, NMFS SEFSC 2007, NMFS SEFSC 2009a).

Based on the analyses presented in NMFS SERO (2009) and the September 17, 2009, memorandum, the combination of the depth closure, endorsement, and hook reduction proposed in Amendment 31 is expected to achieve significant sea turtle bycatch reductions in the bottom longline component of the reef fish fishery. The proposed implementation of a depth closure and hook reduction in the time period prior to Amendment 31's effectiveness is also predicted to reduce sea turtle bycatch substantially. Below we summarize the analyses conducted, including methods, assumptions, and results (i.e., the expected effects the proposed measures would have on sea turtle captures in the bottom longline component of the reef fish fishery). Additional information on and discussion of these analyses is provided in the source documents noted above.

Analyses of effort reductions and resulting sea turtle bycatch reductions that would result from the proposed rulemakings were originally based on October 1 and April 1 effective dates. However, as development of these rulemakings progressed, additional analyses were prepared that shifted the effective dates of both rules forward by one month in anticipation of not meeting the original schedule.

The analyses presented below are based on the original rulemaking schedule. Although October 1, 2009, has passed, basing our estimated reductions in sea turtle bycatch on analyses under the original schedule is actually conservative because it results in us overestimating sea turtle captures in 2009 (i.e., with a later start date, the Eastern Gulf closure of waters 50 fathoms or less to reef fish bottom longline fishing would be effective for a longer time-period so overall sea turtle captures that year would be less). In reality, we cannot predict exactly when each rule would be effective, if approved, but it is still likely that the first rulemaking would publish before November 1. Thus, we did not chose to use analyses prepared assuming the first rulemaking would be effective November 1 because we would have risked underestimating sea turtle captures. For 2010, preserving original analyses provide to us with the original start date had no effect on the overall predicted sea turtle reductions. Because of difference in the distribution of effort across depths under the different management regimes, ultimately, the same overall percent reduction in sea turtle bycatch would be achieved in 2010 despite the delay in full implementation of Amendment 31 and extended time under the preceding rulemaking.

Methods

In order to estimate the effects of the proposed action, baseline effort levels for reef fish bottom longlines were first established. Bottom longline effort was computed as hooks per set times the number of sets per trip and summarized by vessel, month, and year. Consistent with NMFS SEFSC (2008) and (2009a), logbook reported bottom longline effort was assumed to be part of the reef fish fishery if the fishermen reported landings of reef fish using bottom longline gear and the fisherman was not in possession of a directed shark permit or if the fishermen was in possession of a directed shark permit but greater than two-thirds of landings were species other than sharks. Trips with obvious effort reporting errors (e.g., <30 hooks per longline) were omitted, and several steps were taken to diagnose and correct misreporting of depth data. Baseline effort was then computed as the average number of hooks reported on reef fish trips in logbook statistical areas 1-10 (Key West to Pensacola, Florida) during 2007-2008. The years 2007-2008 were selected because they represented the most recent complete time series available and provided the most accurate depth reporting. Because only effort in statistical areas 1-8 (i.e., east of Cape San Blas, Florida) would be impacted by the management measures in Amendment 31, baseline effort in statistical areas 9-10 (approximately 1 million hooks) was removed from the dataset used to analyze the proposed action and then added back into the resultant grand totals as a constant.

In order to estimate overall bottom longline effort reductions in 2009, effort preceding the proposed rulemakings was estimated as follows: From January 1 to May 18, 2009, monthly baseline effort from 2007 through 2008 was used for all depths shoreward of 50 fathoms. Longline effort from May 18, 2009, to September 30, 2009, was set equal zero inside 50 fathoms because of the emergency rule closure. For effort seaward of 50 fathoms, baseline effort from 2007-2008 was used for January-April. For May through June 26, 2009, effort beyond 50 fathoms was estimated using a regression of monthly DWG quota monitoring landings (January to May 2007 and 2008) versus monthly logbook longline effort. The regression showed a strong positive relationship between effort and landings. From June 27 to September 30, 2009, effort was set equal to zero outside of 50 fathoms because of the closure of the DWG fishery.

Beginning October 1, 2009, through March 31, 2010, effort shoreward of 50 fathoms was estimated based on the proposed 35-fathom closure and 750 hook limit. To incorporate potential effort compensation associated with the hook limit, the number of sets for bottom longline vessels currently using more than 1,000 hooks was increased to match the average number of sets made by bottom longline vessels that currently use between 650-850 hooks (note: no adjustment was made if the vessel was currently making more sets than the average level). All effort in 20-35 fathoms was shifted to 35-50 fathoms during the bathymetric closure. Shifted effort was then reduced using a sea turtle density scaler for winter (= 0.636) derived from Garrison (2009).

Starting April 1, 2010, effort was set equal to 2007-2008 baseline effort levels as reduced by a 40K longline endorsement, Jun-Aug 35-fathom closure, and 750 hook limit (i.e., Amendment 31). In evaluating the effects of Amendment 31, the effects of the proposed longline endorsement were considered first. The dataset was filtered to exclude effort from fishing vessels that would not meet the proposed endorsement criteria. Only currently active or renewable permits were considered eligible for longline endorsements. Effort compensation and effort shifting were then handled in the same manner as described above except shifted effort was reduced using a sea turtle density scalar for summer (0.296) derived from Garrison (2009) to reflect the June to August time period of the closure.

For November 2009 and November 2010, only 2007 baseline effort adjusted for the above-mentioned hook limitation was used to predict effort seaward of 50 fathoms. Baseline 2008 effort beyond 50 fathoms was not used because (1) the DWG fishery was opened for 10 days in Nov-2008 due to an early season underage of the quota, thereby greatly affecting the average effort level, and (2) a similar reopening of DWG in 2009 or 2010 was not expected.

Results and Discussion of Assumptions
Based on the methods described above, a 43 percent reduction in bottom longline effective effort is anticipated during 2009 and a 56 percent reduction in longline effort is anticipated during 2010. From 2011 on, effort is anticipated to be reduced annually 60 percent from 2007-2008 baseline levels. In Table 2 (next page), we applied these effective effort reductions to the annual status quo number of loggerhead sea turtle captures, for our estimate of annual captures under the proposed action.

Assumptions upon which are estimated annual captures are based and which are discussed in greater detail in NMFS SERO (2009) and include, but are not limited to:

1. 100 percent of longline effort shifts from 20-35 fathoms to 35-50 fathoms during bathymetric closures (i.e., no fishermen stop fishing during seasonal closures).
2. No longline effort shifts outside of 50 fathoms.
3. 2007-2008 longline effort, as modified by proposed regulations, is representative of future effort.
4. Reductions in effective longline effort directly equate to reductions in sea turtle takes.
5. Fishermen previously using greater than 1,000 hooks per set compensate for the 750 hook restriction by making additional sets.
6. Longline effort shifting from shallower (20-35 fathoms) to deeper water (35-50 fathoms) will result in lower bycatch rates of sea turtles proportional to the differences in sea turtle density provided in Garrison (2009).

Other uncertainties include the accuracy of depth reported, potential changes in fishing behavior that will result from implementation of the Grouper-Tilefish Individual Fishing Quota program, and potential changes in grouper quotas and how those changes will affect effort. Preliminary results from a new red grouper and gag stock assessment indicate these species are overfished, and NMFS must implement measures to end overfishing through regulation within two years.

Although the percent reductions stated above are point estimates, with considerable uncertainty surrounding them, the assumptions made in addressing uncertainty were conservative and each based on the best available information. Thus, most of these uncertainties are likely to result in less effort and fewer sea turtle captures than estimated.

The proposed longline endorsement would limit the number of participants using longline in the Eastern Gulf to 61 permits and reduce longline trips by 54 percent. With endorsement transfers allowed, it is possible a larger vessel could acquire an endorsement from a smaller vessel and increase longline effort in the Eastern Gulf. However, potential effort increases due to endorsement transfers appear to be limited because the frequency distributions by vessel length for qualifying and non-qualifying vessels are comparable.

The Gulf Council and NMFS spent considerable time considering whether or not longline-endorsed vessels would increase their effort once other vessels were eliminated. With no provisions in the IFQ program to prevent endorsed vessels from buying additional catch shares, at first the increasing effort scenario seemed most likely as historically successful vessels will have less competition and may be able to land more fish to fill market demand. However, less competition may mean their catch per unit effort of target species would increase. The recent reduction in the minimum size limit for commercial red grouper from 20 inches to 18 inches (implemented via Amendment 30B) means that longliners will be able to retain a significant portion of their previously discarded catch, likely increasing their target CPUE further. Because a vessel's catch will be limited by its IFQ, these increases in target species CPUE should reduce total effort. Also, although CPUE may increase for the remaining vessels, several upcoming management actions may prevent landings and effort from increasing in coming years. Anticipated reduced red grouper and gag quotas and the regulations required to achieve them given the substantial disparity between the available catch for these co-occurring stocks will likely have a substantial effect on reducing fishing effort above and beyond the effects of Amendment 31. They may further limit the ability of endorsed vessels to expand upon their current level of effort, and indeed are likely to restrict their effort to levels lower than the 2007-2008 baselines.

The assumption that longline effort seaward of 50 fathoms in the Eastern Gulf and in statistical zones 9 and 10 would remain constant at baseline levels was based upon the pending implementation of the Gulf Grouper-Tilefish IFQ program, and the fact that annual quotas for DWG and tilefish have been consistently met during April through June in recent years. The DWG and tilefish quota, along with the grouper-tilefish IFQ, would prohibit any profitable relocation of vessels not qualifying for a longline endorsement into deeper waters.

The evaluation of reductions in effective effort due to the seasonal depth closures was predicated upon the assumption that lower sea turtle densities will result in a linear reduction in sea turtle bycatch. To capture the change in sea turtle bycatch rates likely to result from this closure, the relocated effort was scaled down before being added to the existing effort in 35-50 fathoms. This approach effectively reduced the impact upon sea turtles of the redistributed effort from 20-35 fathom by 70 percent. This reduction is based on the conservative assumption that 100 percent of the baseline effort of endorsed vessels will shift from 20-35 fathoms to 35-50 fathoms, discounting the possibility that effort might be reduced by increased fuel costs from longer transits and possible lower fishing success from fishing non-preferred areas.

Table 5.2 Status Quo and Anticipated Annual Loggerhead Sea Turtle Captures on Reef Fish Bottom Longlines under the Proposed Action

	Status Quo	2009	2010	2011 and Beyond
Total Captures	519	295.8	228.4	207.6
Lethal Captures	314	179	138	126

5.2. Commercial Vertical Line Gear – Effects on Sea Turtles

5.2.1 Types of Interactions (Stressors and Individual Responses to Stressors)

Vertical line gear is known to adversely affect sea turtles as a result of captures via hooking, entanglement, and trailing line. We believe captured sea turtles are almost invariably released alive, but they may later 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. Although there may be some stress associated with capture, forced submergence and its effects on sea turtles are generally not expected to occur because of short soak times and because captured sea turtles may be able to swim and reach the surface, despite having gear attached. Forced submergence is not expected to occur unless entangling lines are caught on an object below the surface and result in the sea turtle not being able to reach the surface. However, other hooking and entanglement injuries described in Section 5.5.1 are certainly still possible.

Of the sea turtles hooked or entangled that do not die from their wounds, some may suffer impaired swimming or foraging abilities, altered migratory behavior, and altered breeding or reproductive patterns. The following discussion summarizes in greater detail the available information on how individual sea turtles are likely to respond to interactions with vertical line gear.

Entanglement

Sea turtles are particularly prone to entanglement as a result of their body configuration and behavior. Fishing gear can drift according to oceanographic conditions, including wind and waves, surface and subsurface currents, etc.; therefore, depending on sea turtle behavior, environmental conditions, and set location, sea turtles can become entangled in fishing gear. Records of stranded or entangled sea turtles reveal that hook-and-line gear wraps around the neck, and foreflippers most frequently, but can also wrap around the body of a sea turtle.

If a sea turtle becomes entangled in monofilament line, the line can inflict serious wounds, including cuts, constriction, or bleeding anywhere on a sea turtle's body. In addition, entangling gear can interfere with a sea turtle's ability to swim, or impair its feeding, breeding, or migration and can force the sea turtle to remain submerged, causing it to drown. The fishing line can also 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.

The one sea turtle observed caught in vertical line was via entanglement. Entanglements are expected to be more common on vertical line because it is lighter, more flexible gear.

Hooking

Sea turtles are injured and killed by being hooked. Hooking can occur as a result of a variety of scenarios, some of which depend on the foraging strategies and diving and swimming behaviors 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, hooking may occur in the gastro-intestinal tract (E. Jacobson in Balazs et al. 1995).

Sea 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 sea turtle's mouth, especially if the hooks have been deeply ingested. Because of a sea turtle's digestive structure, deeply ingested hooks are also very difficult to remove without seriously injuring the sea turtle. A sea turtle's esophagus is attached firmly to underlying tissue; therefore, if a sea turtle swallows a hook and tries to free itself or is hauled on board a vessel, the hook can pierce the sea turtle's esophagus or stomach and can pull organs from their connective tissue. These injuries can cause the sea turtle to bleed internally or can result in infections, both of which can kill the sea turtle.

If a hook does not lodge into, or pierce, a sea turtle's digestive organs, it can pass through to the sea turtle's colon or it can pass through the sea turtle entirely (E. Jacobson in Balazs et al. 1995; Aguilar et al. 1995) with little damage (Work 2000). For example, of 38 loggerheads deeply hooked by the Spanish Mediterranean longline fleet and subsequently held in captivity, 6 loggerheads expelled hooks after 53 to 285 days (average 118 days) (Aguilar et al. 1995). If a hook passes through a sea turtle's digestive tract without getting lodged, the hook probably has not harmed the sea turtle. Tissue necrosis that may have developed around the hook may also get passed along through the sea turtle as a foreign body (E. Jacobson in Balazs et al. 1995).

Trailing Line

Trailing line (i.e., line left on a sea 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 sea turtle and potentially slicing its appendages and affecting 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 sea turtle eventually, leading to impaired movement, constriction wounds, and potentially death.

Forcible Submergence

Forced submergence can occur when a sea turtle becomes entangled or caught on a hook on a line below the surface and is unable to reach the surface to breathe. Section 5.1.1 describes the effects of forced submergence in detail.

5.2.2 Potential Factors Affecting the Likelihood and Frequency of Sea Turtle Interactions with Commercial Reef Fish Vertical Line Gear

A variety of factors may affect the likelihood and frequency of listed species interacting with reef fish vertical line gear. The spatial and temporal overlap between fishing effort and sea turtle abundance and sea turtle behavior may be the most evident variable involved in anticipating interactions. Other fishing related-factors that may influence the likelihood and frequency of hooking, entanglement, and forced submergence effects include gear characteristics (e.g., hook sizes, bait) and fishing techniques employed (e.g., soak times). Each of these factors and its potential influence is discussed briefly below.

Spatial/Temporal Overlap of Fishing Effort and Sea Turtles and Sea Turtle Behavior
The likelihood and rate of sea turtle hookings and/or entanglements in reef fish fishing gears is at least in part a function of the spatial and temporal overlap of sea turtle species and fishing effort. The more abundant sea turtles are in a given area where and when fishing occurs, and the more fishing effort in that given area, the greater the probability a sea turtle will interact with gear. Environmental conditions may play a large part in both where sea turtles are located in the Gulf and whether or not a sea turtle interacts with bottom longline gear.

Hook Type
The type of hook (size and shape) used in fisheries likely plays a role in the probability and severity of interactions with sea turtles. Experiments in pelagic longline fisheries demonstrate the best hook for avoiding sea turtle takes are circle hooks. The configuration of a circle hook reduces the likelihood of foul-hooking interactions because the point of the hook is less likely to accidentally become embedded in a sea turtle's appendage or shell. In some fisheries, circle hooks are wide enough to actually prevent hooking of some sea turtles if the sea turtle cannot get its mouth around the hook (Gilman et al. 2006). Circle hook configuration also reduces the severity of interactions with sea turtles because it has a tendency to hook in the animal's mouth instead of its pharynx, esophagus, or stomach (Prince et al. 2002, Skomal et al. 2002).

The vertical line component of the reef fish fishery has historically used, and is now required to use, circle hooks. Because the commercial vertical line component of the Gulf reef fish fishery uses relatively small circle hooks and catches larger sea turtles than pelagic longline fisheries, we suspect that a circle hook's width would not prevent any hookings (i.e., any sea turtle encountered could get its mouth around the hook), but would reduce the likelihood of any sea turtle caught being hooked internally.

Bait
Sea turtles may be attracted to and bite baited hooks, particularly loggerhead sea turtles. Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hardbottom habitats. Kemp's ridley sea turtles also feed on these species. As such, loggerhead and Kemp's ridley sea turtles may be the species attracted to gear baited with these prey items. Green, hawksbill, and leatherback turtles may still also be attracted to fishing bait and have been caught on fishing hooks, but their feeding habits make it less likely. Green sea turtles become herbivorous as they mature, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan 1988). Leatherbacks feed primarily on cnidarians (medusae, siphonophores) and tunicates so are less likely to pursue bottom longline gear bait.

Bait characteristics (e.g., the type, size, and texture of the bait) may also influence the likelihood and frequency of certain sea turtle species becoming incidentally hooked (See Section 5.1.2 bait discussion).

Soak Time/Number of Hooks
Vertical line gear interactions with sea turtles may be affected by both soak time and the number of hooks fished, independent of overall fishing effort. The longer the soak time, the greater the

chances a foraging sea turtle may encounter the gear and the longer a sea turtle may be exposed to the entanglement or hooking threat, increasing the likelihood of such an event occurring. Likewise, as the number of hooks in the water in a given area increases, so may the likelihood of an incidental hooking event. However, vertical lines typically have short soak times and a limited number of hooks per line.

5.2.3 Extent of the Effects – Estimating the Past Impacts of the Commercial Vertical Line Fishery Component

In NMFS (2005a), we estimated the past effects of the commercial vertical line component of the Gulf reef fishery based on data available through 2004. Two main data sources were considered for estimating sea turtle captures: January through July 1995 SEFSC observer data, and data collected via the then recently implemented SDDP (see Section 2.1.2 for information on this program). The old SEFSC observer data did not document any sea turtle captures, despite there being as many as 15 sea turtles sighted by observers in the action area. However, from August 2001 through July 2004, a total of 11 sea turtles were reported by fishermen participating in the SDDP as being captured on vertical lines. Based on extrapolation of the SDDP-reported captures and fishing effort data in the CFLP and SDDP databases, we estimated a total of 96 sea turtles (65 loggerhead, 13 hawksbill, 9 green, and 9 leatherback sea turtles) were captured triennially and 31 of those sea turtles (20 loggerhead, 3 green, 4 hawksbill, and 4 leatherback sea turtles) were killed by commercial reef fish vertical lines. The same number of captures and mortalities in this fishery component were also anticipated to occur triennially with the continued authorization of the fishery.

Since we completed NMFS (2005a), only six additional sea turtle captures by commercial reef vertical line gear have been documented via the SDDP. Table 5.3 includes data from all SDDP captures reported as of September 2009.

Table 5.3 SDDP Gulf Commercial Reef Fish Vertical Line Sea Turtle Catch Data

Year	Month	Trip Area (Statistical Zone)	Species	No. Caught	Average Weight	Discard Condition
2001	August	7	Loggerhead	1	N/A	Alive
2001	August	4	Unidentified	1	N/A	Alive
2001	August	4	Unidentified	1	N/A	Alive
2001	October	4	Unidentified	1	N/A	Alive
2001	October	4	Unidentified	1	N/A	Alive
2002	April	6	Unidentified	2	N/A	Alive
2002	January	7	Unidentified	1	N/A	N/A
2002	January	7	Unidentified	1	N/A	N/A
2003	September	11	Leatherback	1	80	Alive
2003	November	11	Unidentified	1	7	Alive
2006	April	6	Loggerhead	1	100	Alive
2006	June	7	Loggerhead	1	200	Alive*
2007	September	7	Loggerhead	1	300	Alive**
2008	January	8	Unidentified	1	250	Alive
2008	May	7	Loggerhead	1	60	Alive***
2008	May	11	Loggerhead	1	60	Alive

* Noted on discard form that the sea turtle was "unhooked from mouth and released unharmed."
** Noted on discard form that the sea turtle "dehooked himself quick."
*** Noted on discard form that the sea turtle was captured and discarded in "good condition."

The new reported captures do little to change our characterization of SDDP sea turtle captures in NMFS (2005a). There is still no obvious overall seasonal pattern, with new record occurrence scattered over the last 3 years. All recent reports have been of single capture events. Unlike older reports, almost all (5 out of 6) of the recent sea turtle captures were identified by species (i.e., loggerheads), and they all included estimated average weights. However, because participants were not trained in species identification and weights were estimated only, we are unable to assess the accuracy of these new data. Overall, nearly five times as many reported captures were from the Eastern Gulf than the Western Gulf, despite effort (hook-hours) in the Western Gulf being about two times greater than that of the Eastern Gulf (NMFS SEFSC 2009b). However, four of the six new records were from the region collectively known as Florida's Northern Big Bend (statistical zones 6 and 7), where fishing effort was noted in NMFS (2005a) as being most concentrated. There was also a new take off Apalachicola (statistical zone 8), where none had been previously reported, and one off Alabama-Mississippi border (statistical zone 11). Collectively, these areas represent where 75 percent of reported vertical line takes occurred since the inception of the SDDP.

Starting in July 2006, the RFOP began to observe the vertical line component of the Gulf reef fish fishery. From July 2006 through December 2008, the RFOP observed 197 trips or 265,339 hook-hours. Fifty-five sea turtles, the majority of which were loggerhead sea turtles, were reported sighted (not captured, but seen) by observers in the Eastern Gulf and 5 in the Western Gulf. During that time period, only 1 sea turtle was actually observed captured. On January 30, 2008, a loggerhead sea turtle was observed entangled in leader of a bandit reel. The interaction occurred in the Eastern Gulf off north Florida in statistical zone 8 and is one of the turtles reported in the logbook data. The sea turtle was released alive after being untangled from the leader (SEFSC 2009b).

5.2.3.1 Estimating Total Capture Levels

NMFS SEFSC (2009b) estimated total sea turtle captures and stratified sea turtle captures in the vertical line component of the Gulf reef fish fishery from July 2006 through December 2008 based on sea turtle bycatch documented by the SDDP and RFOP (see Section 2.1.2 for descriptions of these programs). Between the two programs, one sea turtle capture was documented by the RFOP and four captures were documented by the SDDP in the commercial reef fish vertical line component during that time period. Although there were two additional new SDDP records outside of the analysis time period (i.e., in 2006 season 1), the logbook data used were limited to the same time period as the RFOP has been in existence so that the estimates could be compared. Each program’s data were used to calculate sea turtle CPUEs (i.e., catch per hook-hour[10]) by season,[11] by across years by region, and by across years Gulf-wide, and then were extrapolated to total commercial reef fish vertical line hook-hours reported to the logbook. Wilson’s binomial confidence intervals (Wilson 1927) were then calculated for each estimate.

[10] Hook-hours were calculated using the equation: Number of lines fished x Number of hooks per line x total hours fished.

[11] Season 1 (S1) was defined as January 1 through June 31, and season 2 (S2) was defined as July 1 through December 31.

Depending on the temporal and spatial partitioning of effort, the sea turtle CPUE estimated from the RFOP indicates between 81 to 92 sea turtles were captured from July 2006 through December 2008. The CPUE estimated from the SDDP data for the same period indicates between 5 and 18 sea turtles were captured. Table 5.4 summarizes these estimates.

Table 5.4 Estimated Sea Turtle Captures By Season/Region, Across Years/Region, and Across Years Gulf-Wide (Adapted from NMFS SEFSC 2009b)

Reef Fish Observer Program				
Time Period		No. of Sea Turtle Captures by Geographic Area		
Year	Season (S)	Eastern Gulf	Western Gulf	Entire Gulf
2006	2	0	0	--
2007	1	0	0	--
	2	0	0	--
2008	1	92.3	0	--
	2	0	0	--
2006-2008 Seasons Summed	--	92.3	0	92.3
Across years by Region	--	81.3	0	--
Across Years Gulf-wide	--	--	--	82.4
Supplementary Discard Data Program				
Time Period		No. of Sea Turtle Captures by Geographic Area		
Year	Season (S)	Eastern Gulf	Western Gulf	Entire Gulf
2006	2	0	0	--
2007	1	0	0	--
	2	5	0	--
2008	1	6	3	--
	2	0	0	0
2006-2008 Seasons Summed		11.2	2.9	14.1
Across years by Region	--	13.2	4.5	--
Across Years Gulf-wide	--	--	--	4.4

NMFS SEFSC (2009b) presented point estimates with large uncertainty. This is because a number of assumptions inherent to the methods used were either untested or likely violated. The width of the confidence intervals was large (i.e., about 290-460 percent of the midpoint estimate for the Eastern Gulf and 560-580 percent for the Western Gulf), which shows little precision in the midpoint estimate. Overall, the authors of NMFS SEFSC (2009b) were not confident that the estimated confidence intervals encompass the true take estimate for this fishery. The small number of total observed captures in the reef fish fishery (i.e., a single loggerhead sea turtle from the RFOP), and the lack of observed captures in all but one stratum, contribute to the potential inaccuracy of the estimates. NMFS SEFSC (2009b) could not determine the direction of potential bias due to unobserved strata and sparse data associated with relatively low sampling effort; it reports that the number of sea turtles taken in the commercial vertical line component of the fishery is just too few to accurately assess catch rates because they are a rare event.

For the purposes of this opinion, we took a conservative but reasonable approach, based on the best available data. The new SEFSC observer data represent the best available information at this time on which to estimate recent sea turtle bycatch levels in the commercial vertical line component of the Gulf reef fish fishery. As discussed in Section 5.1.3, at-sea observation is believed to be the best mechanism to obtain reliable and accurate bycatch estimates, whereas bycatch data reported in logbooks is believed to be typically underreported. Therefore, although all of the estimates in this particular case are highly uncertain, by selecting an observer-based estimate instead of a logbook-based estimate, we decreased the likelihood of our underestimating the effects this fishery component has on sea turtles. We based our annual estimate of past sea turtle captures on the estimate derived from pooling the data across years by region (i.e., 82 sea turtles caught over a 30-month time period, CPUE of 0.00001703). We did not select the 2008-S1 estimate (i.e., 93 sea turtles, CPUE of 0.00014) because the data suggest the 2008-1 CPUE is not representative of all seasons. With no captures observed in 2007-S2 despite slightly higher observer coverage and a 2.5 percent greater number of observed samples (i.e., 24,024 hook-hours observed in 2007-S2 compared to 9,603 hook-hours in 2008-S1), it is likely that the 2008-S1 CPUE is inflated because of the rare-event nature of interactions. In application, the particular stratification method had little impact on the total estimate.

We did not assume all extrapolated captures were loggerhead sea turtles as NMFS SEFSC (2009b) did. Although loggerhead sea turtles are the most abundant sea turtle in the action area and likely the most frequent caught, we believe the observed sample size (n = 1) is just too small to provide a reliable portrayal of the species that may be captured on commercial vertical lines. It is also possible one or more of the loggerhead sea turtle captures reported to the SDDP was misidentified as a hardshell species. Other hardshell species or leatherback sea turtles were likely captured during the same time period, but at levels too low to be detected with existing sampling, given: (1) all species are known to occur in the action area, (2) the limited sample size of observed and reported sea turtle captures, and (3) a leatherback capture was reported outside of the analyzed time period. It is possible that by assuming captures are not 100 percent loggerhead sea turtles we are underestimating the effects on loggerhead sea turtles. However considering we assumed nearly all bottom longline captures were loggerhead sea turtles, and the method we use to estimate sea turtle captures by species in the next section, we believe we have erred sufficiently on the side of caution in enumerating loggerhead sea turtle effects.

In conclusion, we have determined that 33 sea turtles (i.e., 82 sea turtles/30 months x 12 months) is our best estimate of annual past capture levels in the commercial vertical line component of the Gulf reef fish fishery. This estimate relies on the best available data to quantify captures in the vertical line component of the fishery and accounts for the potential risk commercial vertical line gear has on sea turtles. Although extrapolation with an observed sample of a single loggerhead combined with the overall low coverage levels is by no means precise or statistically reliable, a better estimate cannot be calculated at this time. Comparing this to our NMFS (2005a) three-year sea turtle capture estimate for the commercial vertical line, the estimates are essentially the same (i.e., 96 then versus 99 now).

5.2.3.2 Estimating Captures by Species

In NMFS (2005a), with the exception of leatherback sea turtles, for which we used an estimate based on extrapolation of an actual capture, we essentially assumed sea turtle species were equally likely to be caught per commercial vertical line unit of effort proportional to their overall abundance, based on aerial survey data. Estimated hardshell sea turtle captures were apportioned by species using Epperly et al. (2002) relative sea turtle abundances in the Gulf (based on aerial survey data) and proportional distribution of reef fish fishing effort in each stratum (i.e., Eastern Gulf and Western Gulf, 10-30 fathoms) (see Section 5.3.3.1 of NMFS (2005a) for more detailed explanation). Overall, the relative species abundance for NMFS (2005a) vertical line captures was estimated as approximately 67.7 percent loggerhead, 13.5 percent hawksbill and 9 percent green, and 9 percent leatherback sea turtles. A Kemp's ridley capture was omitted from our estimate as a result of rounding to maintain our estimated total (i.e., 96 sea turtles). We noted our hawksbill and green sea turtle takes were likely biased high, but maintained the estimates were reasonable, based on the best available data.

All five species sea turtles present in the action area have been found entangled in line and with embedded hooks. However, loggerhead and Kemp's ridley sea turtles are expected to be most affected based on their feeding behavior. These species comprise the most frequently reported sea turtle species caught incidentally on vertical line gear.

Leatherback and green sea turtles may be affected by vertical line capture. However, due to their diets and preferred habitats, these species of sea turtles are not as likely to be caught as loggerhead sea turtles. Leatherbacks are the most pelagic of the sea turtles, entering coastal waters on a seasonal basis to feed in areas where jellyfish are concentrated. Leatherbacks feed primarily on cnidarians (medusae, siphonophores) and tunicates. Due to leatherback sea turtles' preferred habitat and diet, leatherbacks are likely to be relatively rare in areas where shallow-water reef fish are targeted with vertical lines, but are known to be quite vulnerable to entanglements when gear is encountered. Sub-adult and adult green sea turtles are primarily herbivorous, feeding on algae and sea grasses. Due to green sea turtles' diet and preference for habitat rich in seagrasses and algae, green turtles may be less common in the hard-bottom areas where reef fish are typically targeted. Also, if present, they are not likely to be as attracted to baited hooks as loggerhead and Kemp's ridley sea turtle, so would be expected to be captured much less frequently.

Hawksbills are the most tropical sea turtle species, ranging from approximately 30°N latitude to 30°S latitude, and adult foraging habitat is typically coral reefs, although other hardbottom communities and occasionally mangrove-fringed bays may be occupied. However, the hawksbill's diet is highly specialized, consisting primarily of sponges; therefore, this species is likely caught most infrequently. From 1998 through 2007, only seven hawksbill sea turtles strandings reported to the STSSN have had hook-and-line attached.

Although Epperly et al. (2002) is still the best available source for sea turtle relative abundance in the Gulf, in this opinion we used a slightly different approach to try and better portray expected differences in sea turtle capture rates rather than just assume the capture rates are only related to their relative abundance. Applying our NMFS (2005a) capture proportions by species to our new annual capture estimates and rounding all numbers to the next largest whole number, would result in an estimated 23 (22.11) loggerhead , 5 hawksbill (4.45), 3 green, and 3 (2.97) leatherback sea turtle capture or 67 (66.33) loggerhead, 14 (13.37) hawksbill, 9 green (8.91) and 9 (8.91) leatherback sea turtles. Considering loggerhead sea turtles are attracted to baited hooks and their greater abundance in the Gulf relative to other species, 67 percent of captures being loggerhead sea turtles seems reasonable. Therefore, of our estimated 99 sea turtle captures every three years in the past, we estimated 67 were loggerhead sea turtles. However, based on our knowledge of sea turtle behavior characteristics and their site/habitat-specific distributions, we were concerned that the leatherback, green, and particularly the hawksbill estimates were biased high. We were also concerned that using this approach did not result in any estimated Kemp's ridley sea turtle captures. Therefore, for the remaining sea turtle species, we looked at their relative occurrence in strandings that had evidence of vertical line interactions and then multiplied those relative proportions by the remaining estimated triennial sea turtle captures (i.e., 32[99-67]). Below we summarize the stranding data used and our sea turtle capture by species results.

Off the Gulf coast of Florida, from 1980 through 2005, there were: (1) Ninety-two sea turtles documented as being caught on recreational hook-and-line and released alive (11 loggerheads, 3 greens, 76 Kemp's ridleys, and 2 sea turtles not identified to species); (2) 86 sea turtles (51 loggerheads, 6 greens, 27 Kemp's ridleys, and 2 not identified to species) documented with what were believed to be one or more recreational fishing hooks on some part of their body or in their gastrointestinal tract, of which 30 of the loggerhead sea turtles and 7 of the Kemp's ridley sea turtles with hooks were found dead; and (3) 204 sea turtles (82 loggerheads, 77 greens, 39 Kemp's ridleys, 3 hawksbills, 2 leatherbacks, and 1 unknown) documented off the Gulf Coast of Florida as either entangled in fishing line or having ingested fishing line (153 cases of entanglement and 51 cases of ingestion), of which 52 loggerhead, 24 green, 23 Kemp's ridley, and 2 hawksbill sea turtles, 1 leatherback sea turtle, and 1 unknown species were found dead. About two-thirds of the sea turtles documented with what were believed to be one or more recreational fishing hooks on some part of their body or in their gastrointestinal tract were found in Southwest Florida (Pinellas Country through Monroe County) and about a third were found from Pasco through Escambia Counties. Almost a third of these fishing line interactions were documented in Monroe County with smaller, but relatively significant numbers occurring in Lee, Pinellas, and Bay Counties (Foley pers. comm. 2009).

Overall, of the total number of sea turtle strandings discussed above that were identified to species, excluding loggerhead sea turtles, 36.9 percent were green sea turtles, 60.9 percent were Kemp's ridley sea turtles, 1.3 percent hawksbill, and 0.8 percent were leatherback sea turtles. Although these percentages stem from what are believed to be recreational vertical line fishing interactions, with no data at this time specific to commercial vertical line, we believe these represent the best available information on which to quantify different vertical line capture rates by species. Therefore, applying the percentages above to 32 sea turtle captures left after estimating 67 loggerhead sea turtle captures, we estimated 11 green and 19 Kemp's ridley sea turtles, 1 leatherback sea turtle, and 1 hawksbill sea turtle. Therefore, overall we estimated 67 loggerhead,19 Kemp's ridley, and 11 green sea turtles, 1 leatherback sea turtle, and 1 hawksbill sea turtle were captured every three years by the commercial vertical line component of the Gulf reef fish fishery.

5.2.3.3 Estimated Mortalities (Immediate and Post-Release)

We believe all sea turtles caught during commercial vertical fishing are released alive. Commercial reef fish fishermen typically retrieve vertical lines within fifteen minutes of their deployment. The one sea turtle observed captured in this fishery component was released alive, and SDDP participants also reported that all 17 sea turtle vertical line captures were released alive. Forcible submergence is extremely unlikely to occur. Except in cases of extreme entanglement, such as hooking combined with bottom-fouling or extremely heavy sinkers with very small sea turtles, hooked sea turtles will be able to surface and breathe. Because sea turtles can likely breath-hold longer than typical soak times, even under stress, it is highly unlikely that a sea turtle caught on a vertical line would be dead upon retrieval of the line.

Post-release mortality criteria specific to sea turtles caught on vertical line interactions do not exist. Sea turtles caught on vertical line gear and released alive would presumably be in better overall health than if released alive from bottom longline gear because of the much shorter soak times and their likely ability to reach the surface of the water to breathe. However, we see no reason why the same factors affecting post-release mortality of sea turtles hooked on bottom longlines (interaction type and amount of gear remaining) would not apply.

NMFS SEFSC (2009b) estimated zero mortality, based on the release condition of the one observed capture via entanglement. Indeed, the post-release mortality of sea turtles entangled, but not hooked, and then released with no attached gear is expected to be very low (i.e., 1 percent) (Ryder et al. 2006). However, hooked sea turtles documented by the SDDP demonstrate not all sea turtles caught in this fishery are entangled and released in this same condition. Consequently, we believe basing post-release mortality on this one entanglement record is inappropriate.

In NMFS (2005a), in the absence of other quantitative data, we conservatively applied the same post-release mortality rates (i.e., 30 percent for hardshell and 40 percent for leatherback sea turtles) to the commercial vertical line component of the Gulf reef fish fishery as we applied to the commercial bottom longline component of the Gulf reef fish fishery. Based on circle hook use and anecdotal information indicating fishers typically just cut the line when sea turtles are caught, we assumed sea turtles were, and would continue to be, hooked in the jaw and released still hooked and with trailing line.

Since September 8, 2006, vessels with commercial (and for hire-reef fish) vessel permits have been required to have sea turtle release gear be onboard when fishing to facilitate the safe release of any sea turtles caught. They are also required to possess specific documents (i.e., NMFS' Sea Turtle Careful Release and Safe Handling Protocols) providing instruction on the safe release of any sea turtle caught. Depending on the level of compliance with these regulations and the skill of fishermen in following these protocols, it is possible that these regulations have reduced post-release mortality in this fishery component. However, these new regulations do not reduce the likelihood of some line break-offs occurring, with sea turtles escaping still hooked and with varying amounts of trailing line. Also, the aforementioned requirements were also implemented in the bottom longline component of the fishery, yet our analysis of recent observer data still documented a 30-percent post-release mortality rate. It may be that these regulations have reduced post-release mortality, but that we under-estimated the mortality rate originally. Regardless, these data do not support revising our previous post-release mortality rate.

In conclusion, absent sufficient information to warrant revising our previous estimate, we conservatively applied the same post-release mortality rates, 30 percent for hardshell and 40 percent for leatherback sea turtles, to our estimated annual captures by species. We therefore estimate 20 loggerhead, 6 Kemp's ridley, 3 green, 1 hawksbill, and 1 leatherback sea turtle were killed triennially.

5.2.4 Extent of the Effects – Anticipated Vertical Line Gear Effects on Sea Turtles under the Proposed Action

The commercial vertical line component of the Gulf reef fish fishery may be impacted indirectly by the proposed action via some level of redirection of effort from longline gear to vertical line gear. We anticipate that all permit holders eligible for a longline endorsement would shift effort into the areas seaward of 35 fathoms during the two proposed closures (see Section 5.1.4) rather than convert to vertical line gear. However, those vessels that would not qualify for an endorsement may convert to vertical line gear in order to continue fishing in waters less than 50 fathoms.

Under the proposed action, the most likely expectation is that some vessels will retrofit their vessels with bandit reel gear. Another possibility being suggested is that some fishermen may attempt to revive the use of buoy gear.

In our preceding section's analysis of estimated past sea turtle captures on commercial vertical lines we did not specifically discuss buoy gear. This is because buoy gear has not been an active vertical line gear type in the Gulf reef fish fishery since the early '90s, and there are no bycatch data available from when it was previously used. The weights that would be used on the gear are estimated to range from one to six pounds, with estimated soak times of one to one and a half hours (GMFMC 2009). Although these estimated soak times are longer than for bandit gear, in most cases sea turtles would likely be able to reach the surface to breath. Heavier weights on some lines could create difficulty for a hooked sea turtle trying to get to the surface to breathe. Because of speculative nature of both the future use of buoy gear and its effects on sea turtles, there is insufficient information to analyze this type of vertical line gear separately from other vertical line gear. However, any future effects stemming from buoy gear use will be considered part of the estimated vertical line impacts.

Based on 2005-2008 logbook data, an average of 116 vessels were identified with reef fish landings harvested using bottom longline gear (NMFS 2009b). The proposed endorsement requirement would limit the longline fleet to 61 vessels, thus may result in up 55 ineligible vessels converting to vertical line.

The extent to which successful gear conversion and increased vertical line effort would occur is unknown. Actual conversion rates as a result of the proposed action are predicted to be affected by the level of historic activity in the fishery (i.e., vessels with higher average annual landings would be expected to have greater access to the funds required for conversion and more incentive to convert in order to remain active in the fishery). Proficiency in using vertical line to successfully catch target species is another factor.

The feasibility of 100-percent conversion rate of longline vessels ineligible for endorsement is doubtful because the conversions of at least several vessels during the emergency rule closure were not successful according to industry representatives. Based on anecdotes of experiences during the emergency closure of 50 fathoms off Florida's west central coast, conversion to vertical line gear has been difficult, and there may be some exodus from the fishery as a result. This was due to a rather steep learning curve for longline fishermen in developing the skills to vertical line fish. Although vertical line fishing is not a new technique, longline gear is very efficient at catching many shallow-water grouper species. Whether, over time, conversion to vertical line gear will increase as individuals become more adept at learning this technique is unknown. As reported by several industry representatives during development of Amendment 31, the losses incurred during the emergency rule closure as captains attempted to vertical line fish were unsustainable and, if continued, would likely force them to close.

According to NMFS port agents, an estimated 75 percent of longline vessels in the Madeira Beach (Florida) area may have converted to vertical line fishing, either permanently or temporarily. Those who have not converted are choosing to fish elsewhere or have chosen to tie vessels to the dock and not fish at all. Some vessels were fishing seaward of 50 fathoms, but stopped when the deepwater grouper fishery closed. To reduce the costs of this conversion, some are using rod and reels rather than permanently installed bandit reels. As a result, many vessels have had reduced landings and are not meeting trip expenses with the amounts of fish landed. For example, overall landings for one fish house have dropped from 100,000 pounds to 5,000 pounds a month according to the manager who said that several employees have been laid off and leased equipment returned (R. Spaeth, pers. comm. in GMFMC 2009). Several vessels home-ported in Cortez, Florida, have also converted to vertical line and have seen a significant reduction in landings (G. Brooks and K. Bell, pers. comm. in GMFMC 2009). Some captains of fleet owned vessels in Cortez have quit or were let go because of an inability to generate sufficient revenue from catches to meet the costs of a fishing trip. In Tarpon Springs, Florida, according to NMFS port agents, one longline vessel has converted to vertical line gear while another is fishing elsewhere. Other vessels may not be fishing at all or no longer homeporting there (GMFMC 2009).

Quota considerations are also relevant to future commercial vertical line effort. Gag grouper harvests are now subject to a quota, as are red grouper and the combined SWG complex. Some species, such as gag, have a higher CPUE for vertical lines, and therefore may show increased landings in some cases (e.g., Table 6.2.2.7 in GMFMC 2009). Preliminary results from a new red grouper and gag stock assessment indicate the quotas for these species may need substantial reductions. In that case, the quotas would be more likely to be reached; however, the new grouper and tilefish IFQ program beginning in January 2010 should restrict catch and prevent closures. In either case, it not likely that vertical line fishing effort will be able to increase substantially.

Funds to assist in gear conversion have been made available from the Environmental Defense Fund (EDF), and 40 vessels were in the process of converting their gear as of September 21, 2009, three vessels have completed the process, and EDF hopes to assist a total of 50 vessels (H. Paffe, EDF, pers. comm. to S. Holiman, SERO, 2009). Overall, it is unknown how many vessels have successfully converted, are in the process of conversion, or will seek to convert. Nevertheless, the most recent economic analysis of the proposed action assumes 40 percent and 60 percent gear conversion rates may bracket the reasonable expected rate of conversion (NMFS 2009e).

Longline trips are, on average, longer in terms of the number of days fished than vertical line trips. The average longline trip expected to be affected by the proposed action lasts approximately 8.5 days, whereas the average vertical line trip lasts approximately 3.5 days (GMFMC 2009). Imposing the historic profile of vertical line trips on converted longline trips required an assumption on how to deal with the difference in trip length. By applying the gear conversion rates to the number of affected longline days fished, rather than the number of affected trips, it is possible to then translate the number of converted days fished to an estimated number of trips using the average number of days fished per vertical line trip. For example, 35 converted days fished with longlines would translate into 10 converted vertical line trips using the average of 3.5 days per vertical line trip (GMFMC 2009).

Based on these differences, one longline vessel would essentially be the equivalent of approximately 2.4 vertical line vessels. Thus, conservatively assuming the 40 longline vessels in the process of converting to vertical line are all successful would be the equivalent of assuming approximately 100 vertical line vessels. Considering the existing fleet consists of a minimum of 700 active vessels, vertical line effort would be expected to increase by approximately 14 percent.

The best available information indicates captures in vertical line gear are rare events, thus it is unknown to what extent potential increases in vertical line effort would result in additional commercial vertical line captures. However, assuming captures are proportional to overall effort, and commercial vertical line effort increases by 14 percent as a result of the reasonable range of gear conversion, we conclude our commercial vertical line captures would increase by the same amount. Applying this rate to our estimated triennial captures (i.e., 99 sea turtles), the proposed action would result in an additional 15 sea turtle captures yielding 114 sea turtles in total. Assuming captures by species and mortality rates remain the same (i.e., approximately 67 percent loggerhead, 12 percent green, 20 percent Kemp's ridley, 1 percent hawksbill, and 1 percent leatherback sea turtles; and 30 percent for hardshell and 40 percent for leatherback sea turtles), we estimate 76 loggerhead, 14 green, and 23 Kemp's ridley sea turtle captures, 1 hawksbill sea turtle capture, and 1 leatherback sea turtle capture and of these, 23 loggerhead, 4 green, 7 Kemp's ridley, 1 hawksbill, and 1 leatherback sea turtles would be lethal.

5.3 Recreational Vertical Line – Effects on Sea Turtles

5.3.1 Types of Interactions

Direct effects on sea turtles include capture by recreational fishermen using hook-and-line methods that could lead to injury and, in some instances, their eventual death. All five species of sea turtles in the action area are known to bite baited hooks. Loggerhead and Kemp's ridley are the species caught most often, and frequently ingest the hooks. Hooked seas turtles have been reported by the public fishing from boats, piers, beaches, banks, and jetties (TEWG 2000). Most sea turtle captures on rod-and-reel, as reported to the strandings network, have occurred during pier fishing, outside of the action area. Fishing piers are suspected to attract sea turtles that learn to forage there for discarded bait and fish carcasses. The amount of persistent debris, including monofilament line, fishing tackle, and other man-made items, has also been found to increase around piers (NMFS 2009f), posing an additional threat to sea turtles in the area. The concentration of reef fish recreational fishing on offshore reefs in the U.S. EEZ may create an environment similar to a fishing pier, potentially making sea turtle captures more likely than in other offshore recreational fisheries.

While there is at least some research on the effects of commercial longline fisheries on the capture of sea turtles, little data exist on the capture of sea turtles as a part of recreational fisheries. Deceased turtles found stranded with hooks in their digestive tract have been reported, though it is assumed that most turtles hooked by recreational fisherman are released alive (NMFS 1991). Some will break free on their own and escape with embedded/ingested hooks and/or trailing line. Others may be cut free by fishermen, and intentionally released. These turtles will escape with embedded or swallowed hooks, or trailing varying amounts of monofilament fishing line which may cause post-release injury or death.

The ingested hook and/or the trailing, monofilament fishing line may ultimately be swallowed and ingested by the animal, potentially leading to constriction and strangulation of the turtles' internal digestive organs; or the line may become entangled around the animals' limbs (leading to limb amputations) or around seafloor obstructions, preventing the animals from surfacing, and leading to drowning. Thus, some of these hooking/entanglement interactions may eventually prove lethal.

5.3.2 Estimating Sea Turtle Captures

In conducting this consultation, we sought new data on which to estimate sea turtle captures in recreational reef fish vertical lines. We first analyzed a new MRFSS pilot study that was implemented in response to a NMFS (2005a) requirement, intended to collect improved data on sea turtle captures in the Gulf reef fish fishery. Next, we updated our NMFS (2005a) analysis based on the new CPUE for commercial vertical line stemming from the RFOP. Last, because of the large spread between the results of these approaches, we analyzed Gulf hook-and-line strandings data. Each of these analyses is reviewed below. We then compared them and stated our best estimate, based on the best available information. There are no changes to the proposed action that would impact the recreational vertical line component of the Gulf reef fish fishery; thus, we assume our estimate of past effects on sea turtles represents future levels as well.

5.3.2.1 Analysis of a MRFSS Sea Turtle Bycatch Pilot Study

In 2006, a sea turtle bycatch pilot study was conducted to collect data on recreational angler interactions with sea turtles and smalltooth sawfish in the Gulf via the MRFSS Angler Intercept Survey. The following supplemental questions (voluntary, check-box responses) pertaining to sea turtles were added to the MRFSS Angler Intercept Survey in the Gulf sub-region as part of this pilot study.

- Did you see a sea turtle on your fishing trip? Yes____ No ____
- If yes:
    - Did you have gear in the water at that time? Yes____ No ___
    - Did you hook or catch one or more sea turtles on your fishing trip? Yes___ No

A total of 35,041 angler intercepts were obtained in the Gulf-region that year and 21,614 add-on sea turtle interaction questionnaires completed (62 percent of anglers interviewed). Of those responses, 1,240 anglers stated they saw a sea turtle; 604 anglers stated fishing gear had been in the water when a sea turtle was seen; and 22 anglers stated they had hooked or caught a sea turtle. Of the 22 responses stating that a sea turtle had been hooked or caught, 4 indicated sea turtle takes occurred in the federal waters of the Gulf of Mexico. Anglers stated they were targeting reef fish species in three of those cases; no target species was denoted for the other response. For the three records reported as targeting reef fish, two of these records occurred off Louisiana, each hooking one hardshell sea turtle. The other record occurred off Florida, hooking a leatherback sea turtle. The record for which no target species was denoted occurred off Florida and hooked two hardshell sea turtles.

Results obtained from statistical analysis of the sea turtle catch question response data were provided to us by the NMFS Office of Science and Technology (OST) (i.e., NMFS OST 2009). Noting that such rare events do not lend themselves to a valid estimation when expanding samples to the population level, at our request, OST used a modified estimation approach to quantify the sea turtle catch rate and develop an approximate measure of the relative uncertainty of that estimator. The resulting catch estimates included total catch of sea turtles by state, mode of fishing, and area fished, and 95 percent confidence intervals were provided for each estimate. The point estimates and estimated variances of the estimators were summed to estimate total catches across different geographic and fishing mode strata. For the Gulf EEZ, this procedure estimated 4,321 hardhsell sea turtles (±5,415) and 199 leatherback sea turtles (± 397) were hooked as a result of all EEZ recreational fishing in 2006 (NMFS 2009c). To get as robust a result as possible with the limited data and because the survey question was not limited to reef fish anglers, OST did not restrict its analysis to effort targeting reef fish species. However, considering reef fish fishing made up approximately 75 percent of all effort in the Gulf EEZ in 2006, OST's analysis indicates an estimated 3,241 hardshells sea turtles and 149 leatherback sea turtles may have been captured by the recreational reef fish fishery subject to our consultation.

The current MRFSS intercept survey does not sample at a high enough level to produce accurate or precise estimates of sea turtles interactions with marine recreational anglers. The 95 percent confidence intervals around the estimates are very large relative to point estimate and they both encompass zero. NMFS OST (2009) concluded that the hooking of sea turtles in the Gulf of Mexico EEZ is very rare and difficult to quantify with the paucity of data available, and is as likely to be estimated as zero with the sample size as any other number within the 95 percent confidence interval. Further, the data were treated as if they had been obtained from simple random sampling. The samples were not collected strictly with a probability sampling design, so the true variances of the estimators are likely to be even higher than the large variance obtained.

5.3.2.2 Analysis Based on the NMFS (2005a) Approach

In NMFS (2005a), no sea turtle interaction data for recreational reef fish vertical line gear were available. In the absence of those data, we quantified the effects of the recreational component of the reef fish fishery by assuming recreational vertical line gear would have the same sea turtle CPUE as estimated from SDDP data for commercial vertical lines. Although we reviewed differences between commercial and recreational vertical line fishing (e.g., number of hooks fished per line, fishing depth and geographic area)--some that suggested recreational sea turtle take levels may be higher; other differences indicated recreational takes would be lower--we concluded the differences would have a negligible impact on hardshell sea turtle CPUE and slightly biased high leatherback estimates. We then applied our estimated commercial vertical line sea turtle CPUEs to estimated recreational reef fish vertical line effort, based on MRFSS and Headboat Survey 2001-2003 data. Based on our analysis, recreational fishing from 2001-2003 resulted in an estimated 35.7 million (35,653,521) hook-hours of fishing effort and an estimated total of 101 hardshell sea turtles and 10 leatherbacks were caught over that 3-year time period. We made no attempt to quantify the precision or variance associated with the CPUE or our estimate.

To calculate sea turtle captures by the recreational vertical line component, we basically followed the same NMFS (2005a) approach, but used the new observer-based commercial vertical line CPUE from our commercial vertical line analysis (i.e., 0.00001703) and updated Gulf EEZ reef fish recreational fishing effort data from during that same time frame (i.e., 2006-2 through 2008-2). A mean of 18,497,276 hook-hours was estimated (95% C.I. 12,863,815-25,002,516) for recreational fisheries in the EEZ off West Florida and Alabama from July 2006 to December 2008. Estimated effort was then multiplied by the computed commercial vertical line CPUE. Binomial confidence intervals consistent with the method used in NMFS SEFSC 2009b were calculated this time to better account for the uncertainty associated with results. This analysis yielded an annual estimate of 125 (95% C.I. 15-964) sea turtle captures.

5.3.2.3 Analysis of Sea Turtle Stranding Data Associated with Vertical Line Gear

The Sea Turtle Stranding and Salvage Network (STSSN) was formally established in 1980 in response to the need to better understand the threats sea turtles face in the marine environment, to provide aid to stranded sea turtles, and to salvage dead sea turtles that may be useful for scientific and educational purposes. The STSSN collects information on and documents strandings and incidental captures of sea turtles along the U.S. Gulf of Mexico and Atlantic coasts. The SEFSC currently maintains this database. The network encompasses the coastal areas of 18 states, including all the states in the Gulf of Mexico and South Atlantic region. Network participants document sea turtle strandings and incidental captures in their respective states, noting any fishing gear or other marine debris associated with the animal. The data are then entered into a central STSSN database.

STSSN data available for estimating recreational fishing and sea turtle interactions stem from opportunistic observations, reported incidental captures, and documented stranded animals with hooks and/or line still attached. Incidental captures are captures documented during a particular fishing activity. Stranding is the term used to describe when a sea turtle swims or floats into shore and becomes "beached" or is stuck in the water. The main distinction between incidental capture and stranding is whether any fishing gear associated with the animal appears to be actively fishing. Most incidental captures are reported by fishermen or enforcement officers--the sea turtles may be either dead or alive, but the gear must be active. Strandings too, may be either dead or alive, as well as beached or floating, but any fishing gear associated with the animal is not actively being fishing (e.g., line only, old gear in disrepair/heavily fouled, gear on beach with turtle, etc.).

Strandings can be a valuable source of data. Stranding data are often used to monitor sea turtle nearshore mortality rates and sometimes used as an indicator of the relative distributions and abundances of different species and sizes of sea turtles. They are also sometimes used to provide information on mass mortality events and potential mortality factors, fisheries impacts on sea turtles and other marine species, where mortality may be occurring, and to direct further observations. Likewise, when combined with other data, stranding information can also shed light on how anthropogenic impacts that occur at sea, and are otherwise difficult to study, are affecting aggregations.

Stranding data also have limitations. For example; (1) Not all sick or dead sea turtles strand; thus, sea turtle stranding data represent only a subset of all dead turtles, and the total proportion that strand is unknown. Factors affecting the likelihood of stranding include distance from shore, current and wind direction, bathymetry, marine scavengers, decomposition condition, presence of beaches, and accessibility of coastline. (2) Even if a sea turtle does strand, that does not mean it is necessarily discovered, reported, and documented by the STSSN. Whether or not a stranding is detected depends on the frequency of strandings in an area, frequency of beach monitoring, availability of network volunteers to respond to a stranding event, and experience and training of those volunteers. (3) Decreases or increases in stranding numbers may not be due to decreases or increases in mortality rates. For example, mortality rates may remain unchanged but decreases or increases in local turtle populations may result in changes in the number of strandings. (4) Stranding information does not indicate where a potential mortality event (e.g., hooking, vessel strike) occurred, as a sea turtle could have been injured/killed at one location and then drifted with wind or currents for a considerable distance before being documented. (5) Last, when sea turtles do strand and are reported as such, often the cause of the stranding is unknown.

For all of the reasons just described, attributing strandings to any specific fishery can be particularly difficult and in many cases is not possible. Only a small proportion of the animals that strand can be reliably attributed to fishing interactions, and fewer still can be attributed to specific fisheries (Murphy and Hopkins-Murphy 1989, Epperly et al. (1996)). TEWG (1998) estimates sea turtle strandings may represent as little as 5-6 percent of actual at-sea nearshore-mortality events.

Off the Gulf coast of Florida, from 1980 through 2005, there were: (1) Ninety-two sea turtles documented as being caught on recreational hook-and-line and released alive (11 loggerheads, 3 green turtles, 76 Kemp's ridleys, and 2 sea turtles not identified to species); (2) 86 sea turtles (51 loggerheads, 6 green turtles, 27 Kemp's ridleys, and 2 not identified to species) documented with what were believed to be one or more recreational fishing hooks on some part of their body or in their gastrointestinal tract, of which 30 of the loggerhead sea turtles and 7 of the Kemp's ridley sea turtles with hooks were found dead. [About two-thirds of the sea turtles documented with what were believed to be one or more recreational fishing hooks on some part of their body or in their gastrointestinal tract were found in Southwest Florida (Pinellas Country through Monroe County) and about a third were found from Pasco through Escambia Counties]; and (3) 204 sea turtles (82 loggerheads, 77 green turtles, 39 Kemp's ridleys, 3 hawksbills, 2 leatherbacks, and 1 unknown) documented off the Gulf coast of Florida as either entangled in fishing line or having ingested fishing line (153 cases of entanglement and 51 cases of ingestion), of which 52 loggerhead, 24 green, 23 Kemp's ridley, and 2 hawksbill sea turtles, 1 leatherback sea turtle, and 1 unknown species were found dead. Almost a third of these fishing line interactions were documented in Monroe County with smaller, but relatively significant numbers occurring in Lee, Pinellas, and Bay Counties. The incidences of all of these interactions along the Gulf coast of Florida have been rising through recent years (Foley pers. comm. 2009).

Based on the stranding information presented above, annual average estimates of Florida Gulf strandings related to hook-and-line are as follows: 6 sea turtles documented as being caught on hook-and-line, 9 sea turtles documented with what were believed to be one or more recreational fishing hooks on some part of their body or in their GI tract, and 14 sea turtles documented either to be entangled in fishing line or to have ingested fishing line (10 cases of entanglement and 4 cases of ingestion). If we assume that all of these strandings are attributed to state recreational fishing and that they represent only 5 percent of actual annual strandings, then estimated annual nearshore Florida Gulf strandings would be 580 sea turtles.

A query of the STSSN database for all Gulf-wide sea turtle strandings (including the Gulf coast of Florida) showing evidence of hook-and-line interactions in 2005, 2006, and 2007 found 27, 22, and 47, respectively (W. Teas and L. Belskis, SEFSC STSSN Coordinators, pers. comm. 2009). If we assume documented strandings represent only 5 percent of actual mortalities, then actual nearshore mortalities may have been 540, 440, and 940 for each year, respectively.

5.3.2.5 Discussion

The wide range of potential effects on sea turtles from the recreational component of the reef fish fishery is cause for concern. Three different data sources/approaches for estimating sea turtle bycatch by the recreational vertical line component of the Gulf reef fish fishery were presented above; each providing a different capture estimate. The 95 percent C.I.s of both the MRFSS estimate and our updated NMFS (2005a) estimate overlap with the estimate in the previous opinion (i.e., 37 sea turtles annually); thus, we cannot truly ascertain whether or not our previous take estimate has been exceeded and, if so, to what extent. Despite our attempts to better estimate recreational incidental captures, these estimates merely better capture how poor and uncertain our total recreational incidental capture estimates are, let alone any estimates for a particular species.

To narrow down the range of uncertainty between our estimates stemming from the MRFSS add-on questions and from the NMFS (2005a) approach, we also looked at strandings associated with fishing hooks and monofilament line suspected to come from recreational fishing. Strandings are likely most representative of effects on sea turtles stemming from the collective sum of nearshore recreational fisheries, but can also include animals that have stranded from interacting with offshore fisheries anywhere in the Gulf. Because of this, we would expect the collective sum of Gulf recreational fisheries, particularly nearshore fisheries where at least some sea turtle species are more abundant, to cause a far greater number of sea turtle captures than fishing solely for reef fish in the EEZ. Therefore, we used our extrapolated strandings estimates as a proxy for all Gulf sea turtle captures in recreational fisheries and to help us consider what might be a reasonable capture level for the recreational vertical line component of the Gulf reef fish fishery.

We concluded that our capture estimate produced by using the NMFS (2005a) approach with our updated data (i.e., 125 annual sea turtle captures or 375 sea turtles triennially) is the most reasonable estimate of sea turtle captures in the recreational vertical line component of the Gulf reef fish fishery. Although the point estimate stemming from our MRFSS pilot study was much higher, given so few actual reported captures in the recreational vertical line component of the Gulf reef fish fishery (e.g., 4 in the MRFSS sea turtle pilot), we do not believe we have underestimated the risk to sea turtles that recreational vertical lines have posed by using the NMFS (2005a) approach instead. This is because, after considering an estimated 440 to 940 sea turtle captures potentially resulting from recreational vertical line fishing Gulf-wide, we believe that sea turtle captures in the thousands attributed to a single offshore recreational fishery, such as the recreational vertical line component of the Gulf ref fish fishery, seem implausible. It is well established that extrapolation of rare events when they are observed in small samples can result in grossly overestimated results (e.g., Nelson and Farber 1998), and we believe this is likely true in this particular case. In fact, by this same logic it is possible that by using the updated NMFS (2005a) approach, we are still overestimating sea turtle captures, considering the CPUE is based on a single observed capture. However, as discussed in Section 5.2.3.1, we believe selecting an estimate based on observer data instead of a logbook data, which is known to be biased by under-reporting, decreases the likelihood of our underestimating effects on sea turtles.

5.3.3 Sea Turtle Captures by Species

In NMFS (2005a), estimates of vertical line sea turtle captures by species were prepared separately for hardshell sea turtles and leatherbacks. We estimated 10 leatherback sea turtles would be captured, based on extrapolation of the one SDDP vertical line bycatch record identified as a leatherback. Estimated hardshell sea turtle captures were then apportioned by species using Epperly et al. (2002) relative abundance estimates and the proportional distribution of reef fish fishing effort in each stratum (Eastern and Western Gulf, 10-40 fathoms) (see Section 5.3.3.1 of NMFS (2005a) for more detailed explanation). Although we discussed what we knew about each sea turtle's behavior characteristics and habits and how our estimates may be biased by the method used estimate captures by species, we did not adjust our estimates to reflect that information. Overall, the relative species abundance proportions applied in NMFS (2005a) were 47.7 percent loggerhead, 27.9 percent hawksbill, 14.4 percent green, 9 percent leatherback, and 0.9 percent Kemp's ridley sea turtles.

Applying these same proportions to our estimated captures would result in approximately 60 (59.6) loggerhead, 31 (31.0) hawksbill, 16 (16.0) green, and 10 (9.99) leatherback sea turtles, and 1 Kemp's ridley sea turtle. However, in this opinion we used a slightly different approach to try and better portray expected differences in sea turtle capture rates rather than just assume the capture rates are only related to their relative abundance. Based on our knowledge of sea turtle behavior characteristics and their site/habitat-specific distributions (see Section 5.2.3.2), we were concerned that the above estimates did not portray expected differences in sea turtle capture rates. Considering loggerhead sea turtles seem to be most attracted to baited hooks and their greater abundance throughout the action area relative to other species, particularly in the Eastern Gulf, where the majority of recreational reef fish fishing occurs, we were concerned that our loggerhead estimate was biased low. We were also concerned that the leatherback, green, and particularly the hawksbill estimates were biased high, and that using this approach did not result in any estimated Kemp's ridley sea turtle captures.

Given the similarities between commercial and recreational vertical lien sectors, we would expect the number of recreational vertical line capture of loggerhead sea turtles to be similar to commercial vertical line. We also believed it would be more appropriate and protective of declining loggerhead sea turtle populations to assume the same proportion of loggerhead sea turtle captures in the recreational vertical line component. For the other species, we believed the species proportions stemming from what are believed to be recreational vertical line fishing interactions would be the best available information on which to quantify different recreational reef fish vertical line capture rates by species. For those reasons, we applied the same revised species proportions from our commercial vertical line analysis (i.e., approximately 67 percent loggerhead, 12 percent green, 20 percent Kemp's ridley, 1 percent hawksbill, and 1 percent leatherback) to our estimate or triennial sea turtle captures by the recreational vertical line component of the Gulf reef fish fishery. Based on the results, we estimate 254 loggerhead, 74 Kemp's ridley, and 45 green sea turtles, 1 hawksbill sea turtle, and 1 leatherback sea turtle are captured every three years in the recreational vertical line component of the Gulf reef fish fishery.

5.3.4 Estimated Mortality

In considering the impact of reef fish recreational fishing, estimating mortality is of the utmost importance. If the expected mortality rate is low, our lack of precision in estimating takes is of somewhat less concern. Conversely, if mortalities are relatively common, our total take estimate would take on greater importance.

Fortunately, we are confident that immediate mortality is not a concern for this fishery. All data sources reviewed indicate all takes have been released alive; there is no evidence to suggest otherwise. However, some post-release mortality may be experienced from stress of multiple captures, entanglement causing limited mobility, and ingestion of hooks and line potentially interfering with food intake and digestion. Sea turtles occasionally found stranded (both live and dead) with hooks and line still attached indicate gear is sometimes left on individuals caught with vertical line.

As stated in our commercial vertical line analysis, there are no criteria for assessing sea turtle post-release mortality from vertical line interactions. In the 2005 opinion, we stated sea turtles caught on recreational vertical line gear and released alive would presumably be in better overall health than if released alive from bottom longline gear because of the shorter soak times and ability to reach the surface of the water to breathe. However, we also saw no reason why the same factors affecting post-release mortality of sea turtles hooked on bottom longlines (interaction type, hooking location, and amount of gear remaining) would not apply. With no new information to quantify a post-release mortality level for recreational vertical lines from existing data, we conservatively applied the same post-release mortality criteria and estimated mortality percentages (i.e., 30 percent for hardshell and 40 percent for leatherback sea turtles) as used for our commercial estimates to the recreational sector. Applying these rates of mortality to our capture estimates, we estimate a total of 76 loggerhead, 22 Kemp's ridley, and 14 green sea turtles, 1 hawksbill sea turtle, and 1 leatherback sea turtle will die every three years as a result of their capture on recreational reef fish vertical lines.

5.4 Hook-and Line Gear—Sawfish Effects

5.4.1 Types of Interactions (Stressors and Individual Responses to Stressors)

Bottom longlines and commercial and recreational vertical line gear can adversely affect smalltooth sawfish via hooking and entanglement. Based on hooking observation data from Mote Marine Laboratory bottom longline research surveys and reported recreational rod and reel fishing encounters, the vast majority of smalltooth sawfish are hooked in the mouth (Simpfendorfer, pers. comm. 2003; Burgess, pers. comm. 2003; Seitz and Poulakis, pers. comm. 2003). Foul hooking (i.e., hooking in fin, near eye, etc.) reports are not nearly as frequent, but do occasionally occur. There is only one report of a smalltooth sawfish being deeply hooked (National Sawfish Encounter Database [NSED], May 2009). Once hooked, the gangion or leader frequently becomes wrapped around the animals' saw (Burgess, pers. comm. 2003; Seitz and Poulakis, pers. comm. 2003). This may be from slashing during the fight, spinning on the line as it is retrieved, or any other action bringing the rostrum in contact with the line.

Based on available data, all smalltooth sawfish caught on vertical lines and the vast majority of smalltooth sawfish caught on bottom longline gear survive the encounter. Between 1994 and 2008, 15 smalltooth sawfish have been observed caught in the Atlantic and Gulf bottom longline component of the HMS shark fishery. One of the captured animals was killed as a result of becoming tangled in the gangion and mainline in 2007. The remaining captured animals were documented as very active when reaching the water's surface and were released in apparent good health. Soak times do not seem to be a factor for smalltooth sawfish mortality. Simpfendorfer speculates this is because the animal's natural habit consists of lying on the seafloor, using its spiracles to breathe (Simpfendorfer, pers. comm. 2003). Thorson (1982) reports that largetooth sawfish caught by fishermen at night or when no one was present to tag them were left tethered in the water with a line tied around the rostrum for several hours with no apparent harmful effects. Additional information stems from Dr. Simpfendorfer and Tonya Wiley of MML, who conducted smalltooth sawfish surveys from 2000-2008, using bottom longline, nets, and rod and reel. Dr. Simpfendorfer and Ms. Wiley captured and handled over 130 individuals ranging in size from 62 cm to 496 cm, which were caught on bottom longlines (T. Wiley, pers. comm. 2009). All of these fish were alive upon capture and safely released with no apparent harm to the fish.

There are no studies on the post-release mortality of smalltooth sawfish. However, based on their lively condition at capture and MML tagging recapture data, post-release mortality is expected to be extremely rare. A few rare reports from recreational fishers indicate smalltooth sawfish can damage their rostrum by hitting it against the vessel or other nearby objects (e.g., piling, bridge) while the fishers are preparing to release the fish. Reported damage ranges from broken rostral teeth to broken rostrums. Smalltooth sawfish have been caught missing their entire rostrum, otherwise appearing healthy, so they appear to be able to survive without it. However, given the rostrum's role in smalltooth sawfish feeding activities, damage to their rostrum, depending on the extent, could hinder their ability to feed and ultimately impact the affected animal's growth.

5.4.2 Potential Factors Affecting the Likelihood and Frequency of Smalltooth Sawfish Interactions with Hook-and-Line Gear

A variety of factors may affect the likelihood of smalltooth sawfish interactions with hook-and-line gear. The spatial overlap between fishing effort and smalltooth sawfish abundance is the most noteworthy variable involved in anticipating interactions. Other important factors for determining the likelihood and frequency of interactions include the types of gear used (e.g., baits, hooks) and the fishing techniques employed.

Spatial/Temporal Overlap between Fishing Effort and Smalltooth Sawfish
The spatial distribution of smalltooth sawfish influences the rate of interaction with fishing gears. The more abundant smalltooth sawfish are in a given area where fishing occurs, the greater the probability a sawfish will interact with gear. The temporal distribution of fishing effort and smalltooth sawfish abundance is also a factor.

Different life stages of smalltooth sawfish are associated with different habitat types and water depths. Very small and small juvenile smalltooth sawfish are most commonly associated with shallow water areas of Florida, close to shore and typically associated with mangroves (Simpfendorfer and Wiley 2004). Since larger (> 200 cm in length) size classes of the species are also observed in very shallow waters, it is believed that smaller (younger) animals are restricted to shallow waters, while larger animals roam over a much larger depth range (Simpfendorfer 2001). Poulakis and Seitz (2004) observed that nearly half of the encounters with adult-sized sawfish in Florida Bay and the Florida Keys occurred in depths from 200 to 400 ft (70 to 122 m). Simpfendorfer and Wiley (2005) also reported encounters in deeper water off the Florida Keys, noting that these were mostly reported during winter. Observations on commercial longline fishing vessels and fishery independent sampling in the Florida Straits report large sawfish in depths up to 130 ft (~40 meters) (John Carlson and George Burgess, pers. comm.).

Large juveniles and adult smalltooth sawfish are known to occur in water depths of 100 m or more. Thus, gears deployed in deeper water are more likely to encounter these two size classes.

Soak Time/Number of Hooks
Bottom longline gear interactions with smalltooth sawfish may be influenced by both soak time and the number of hooks fished. The longer the soak time, the longer a smalltooth sawfish may be exposed to an entanglement or hooking threat, increasing the likelihood of such an event

occurring. Likewise, as the number of hooks fished increases, so does the likelihood of an incidental hooking event.

Hook Type
The type of hook (size and shape) may impact the probability and severity of interactions with smalltooth sawfish. The point of a circle hook is turned toward the shank, while the point of a J-hook is not. Thus, the configuration of a circle hook, the most common hook type in the Gulf reef fish fishery, may reduce the likelihood of foul-hooking interactions because the point of the hook is less likely to accidentally become embedded in the smalltooth sawfish's mouth. Circle hooks are also expected to reduce gut-hookings.

Bait
Smalltooth sawfish feed primarily on fish and crustaceans. Mullet, jacks, and ladyfish are believed to be their primary food sources (Simpfendorfer 2001). Smalltooth sawfish are reported to subsist on schooling fish such as mullet and clupeids (NMFS 2009b). There are currently no directed studies on the attraction of smalltooth sawfish to bait used in the Gulf reef fish fishery.

Environmental Conditions
Environmental conditions may also play a large part in whether or not a smalltooth sawfish interacts with hook-and-line gear. Fishing gear can drift according to oceanographic conditions, including wind and waves, surface and subsurface currents, etc.; therefore, depending on these species' behavior, environmental conditions, and location of the set, smalltooth sawfish can become entangled in the gear.

5.4.3 Estimating Smalltooth Sawfish Captures

For this opinion, we searched available databases (i.e., SEFSC observer databases and NSED) for any new records of smalltooth sawfish captured on commercial reef fish hook-and-line gear documented since NMFS (2005a). We considered the results of our new search relative to our previous capture estimates to see if there was any new information warranting revision of our previous estimates. We also considered what effect the proposed action would have on previous commercial capture levels.

Commercial Bottom Longline
In NMFS (2005a) we estimated two smalltooth sawfish were caught on reef fish bottom longlines every three years. At that time, we knew at least one smalltooth sawfish had been caught on reef fish bottom longline gear in Gulf U.S. EEZ waters between 2001 and 2004. Poulakis and Seitz (2004) had documented that a smalltooth sawfish estimated to be 2.4 m in total length was caught in 2001 on a bottom longline targeting grouper in federal waters off the Dry Tortugas. In addition to that capture, we also believed it was likely a second smalltooth sawfish had been captured during that time frame, but was not reported (see NMFS 2005a for explanation and further detail). Based on previous interaction observations, we estimated both captures were released alive with only short-term sub-lethal effects.

Our search of available databases for this opinion revealed three additional smalltooth sawfish captures on reef fish (i.e., grouper) bottom longlines. There was one report of two smalltooth sawfish being captured in 2004 in the Gulf EEZ approximately off Fort Myers; we did not detect these captures in NMFS (2005a) either because the record was added to the database after we searched or was missed in error. In addition to that report, we found a report documenting a smalltooth sawfish capture in April 2005 in the Gulf EEZ off Naples, Florida.

Based on this new information, we previously underestimated the number of smalltooth sawfish captures in NMFS (2005a) (i.e., three instead of one documented), but have not exceeded our estimate since then (i.e., only one documented in the past 4+ years). Overall, we now have four records documented between 2001 through 2008, thus averaging only one capture every couple of years. The proposed action is expected to reduce overall bottom longline effort substantially (see 5.1.4 for details) and shift effort during proposed closures to deeper waters; thus, potentially reducing the likelihood of smalltooth sawfish captures in the future. However, it is unlikely the proposed action will have a detectable effect on smalltooth sawfish because their capture is too rare to be affected in a uniform way. We conclude there is no reason to change our previous estimate of two captures every three years.

Commercial Vertical Line

NMFS (2005a) estimated two smalltooth sawfish were caught on commercial vertical lines every three years. The estimate was based on: (1) two reports of smalltooth sawfish in the GOM EEZ off southwest Florida on recreational vertical line gear, (2) our expectation that captures on commercial vertical line would be less than on recreational vertical lines because more fishing effort occurred outside of where smalltooth sawfish typically occurred, and (3) the likelihood of a smalltooth sawfish captured but not reported in the central and northern Gulf. Based on interaction observations, these captures were likely released alive with only short-term sub-lethal effects.

Based on our review of available databases, there are still no reports of smalltooth sawfish captures on commercial vertical line gear. Also, no new recreational captures have been documented since 2005 (NSED, May 2009). We conclude that our estimate of two smalltooth captures ever three years is still our best estimate, based on available information.

Recreational Vertical Line

In NMFS (2005a), we estimated four smalltooth sawfish would be captured every three years. Our estimate was based in part on two reported smalltooth sawfish captures on recreational vertical lines targeting reef fish. In April 2002, a smalltooth sawfish about 4.6 m long was caught on vertical line gear by an angler fishing for reef fish near an oil rig structure in the GOM, nine and a half miles west southwest of Flamingo, Florida. The other smalltooth sawfish, estimated to be 6.1 m in total length, was reported as being caught “recently” on vertical line gear in the GOM, ten miles off East Cape, Florida. Although the fishing target and structure were not noted for the second report, given the location the angler was likely targeting groupers or snappers over some sort of hard bottom (Poulakis, pers. comm. 2004). We also assumed two more smalltooth sawfish may have been caught, but not reported (see NMFS 2005a for additional explanation). Based on previous interaction observations, all four captures were estimated to be non-lethal.

No new recreational captures have been documented since 2005 (NSED, May 2009), and no other new information has been revealed that calls the previous estimate into question. Therefore, our previous estimate of four non-lethal smalltooth sawfish captures every three years remains our best estimate of smalltooth captures for the crecreational vertical line component of the Gulf reef fish fishery.

5.5 Reef Fish Vessels – Effects of Vessel Strikes

5.5.1 Effects on Sea Turtles

Reef fish vessels transiting to and from fishing areas and moving during fishing activity pose a threat to sea turtles. Based on recorded sizes of stranded sea turtles with propeller injuries, both juvenile and adult sea turtles are subject to vessel strikes. Young sea turtles are very alert and so less likely to be hit by a vessel. Sea turtles are highly susceptible to vessel collisions and propeller strikes because they regularly surface to breathe and may spend a considerable amount of time on or near the surface of the water. Activities such as basking, mating, and resting at the surface also make these animals susceptible to vessel strikes. For example, Sobin (2008) suggests loggerhead sea turtles are most vulnerable to boat strikes following a false crawl event, within 12 hours after nesting and the night before returning to the beach to nest, during when they are closest to shore and also subject to high traffic boat areas. Sea turtle stranding data also indicates sea turtle species are more susceptible to being hit by boat propellers during movements associated with reproductive activity (Foley et al. 2008). Sick and injured sea turtles typically float so are also particularly vulnerable to being struck by vessels.

5.5.1.1 Types of Interactions (Stressors and Individual Responses to Stressors if Exposed)

Vessel strikes may result in direct injury or death through collision (concussive) impacts or propeller wounds. Although sea turtles, with the exception of leatherback sea turtles, have hard carapaces, they are unable to withstand the strike of a rapidly moving vessel or the cut of a propeller. A sea turtle’s spine and ribs are fused to the shell, which is a living part of their body that grows, sheds, and bleeds. Rapidly moving vessels may strike the head or carapace and result in fractures. Injuries to the carapace can involve fractures to the spinal column and buoyancy problems. A propeller can easily cut through the shell and sever or damage the spine and internal organs. Propeller injuries may range from mild to severe and include head lacerations, eye injury, injury to limbs, and carapace lacerations and fractures. Chronic and/or partially healed propeller wounds also may be associated with secondary problems such as emaciation and increased buoyancy (Walsh 1999). Abnormally buoyant sea turtles are unable to dive for food or escape predators or future vessel strikes. Seriously injured or dead turtles may be struck multiple times by vessels before they drift ashore.

The proportion of vessel-struck sea turtles that survive or die is unknown. In many cases, it is not possible to determine whether documented injuries on stranded animals resulted in death or were post-mortem injuries. Sea turtles found alive with concussive or propeller injuries are frequently brought to rehabilitation facilities; some are later released and others are deemed unfit to return to the wild and remain in captivity. Sea turtles in the wild are documented with healed injuries; thus, we know at least some sea turtles survive without human intervention.

5.5.1.2 Potential Factors Affecting the Likelihood and Frequency of Sea Turtle Exposure to Vessel Strikes

The threat posed by moving vessels is not constant and is influenced in part by vessel type (planing versus displacement hulls), vessel speed, and environmental conditions such as sea state and visibility. Seasonal and regional variance in vessel use and sea turtle distribution and densities also are expected to affect sea turtle vessel strike rates. Below we review how these factors may affect the likelihood and frequency of sea turtle vessel strikes.

Vessel Type and Speed

Generally, vessels typically possess either a planing hull or a (semi-)displacement hull. Planing hulls, typical of smaller (e.g., 18-27 feet in length) recreational vessels, are designed to run on top of the water (i.e., on plane) at high speeds. Conversely, displacement hulls push through the water, as they have no hydrodynamic lift, and the boat does not rise out of the water as speed increases. Because of how these two hulls function, they likely introduce differing threat risks to sea turtles. For example, because operational speeds of planing hulls are typically greater than displacement hulls, they possess greater kinetic energy to transfer to an impacted sea turtle. Additionally, because most of the hull is out of the water, the running gear (including the propeller and skeg of an outboard) of a planing hull running at speed becomes a significant cutting/slashing threat, in combination with the concussive effect of a collision. This risk would be compounded by twin or triple engines, which are fairly common in small- to medium-sized (e.g., 25-34 feet in length) recreational reef fish vessels. In comparison, displacement hulls, which include most large (e.g., > 65 feet in length) vessels comprising commercial traffic (e.g., tankers, freighters, tugs, etc.), while traveling slower extend deeper into the water column. The slower speed and greater size of these vessels suggests the risk to sea turtles is largely limited to a concussive impact from the hull. It is possible that a sea turtle may avoid significant impact altogether by being pushed away by the hydrodynamic bow wave of a large vessel, and, therefore, allowed to escape before incurring an injury.

Greater vessel speed is expected to increase the probability that a sea turtle would fail to have to time to flee the approaching vessel and that the vessel operator would fail to detect and avoid the sea turtle. A study on vessel speed and collisions with green sea turtles conducted in shallow water (<5 m) along the northeastern margin of Moreton Bay, Queensland, Australia, analyzed behavioral responses of benthic green sea turtles to an approaching 20-ft (6-m) aluminum vessel at slow (2 knot), moderate (6 knot), and fast (10 knot) speeds (Hazel et al. 2007). The proportion of turtles that fled to avoid the vessel decreased significantly as vessel speed increased, and turtles that fled from moderate and fast approaches did so at significantly shorter distances from the vessel than turtles that fled at slow approaches. Although vessel noise is within a green turtle's hearing range, there are several factors that may impede their recognition of the noise as a threat (e.g., directionality of the noise in the ocean and habituation to background vessel noise). The results implied that vessel operators could not rely on sea turtles to actively avoid being struck by a vessel if it exceeds 2 knots. On this basis, the authors determined that vessel speed was a significant factor in the likelihood of a strike and implied that mandatory vessel speed restrictions were necessary to reduce the risk of vessel strikes to sea turtles (Hazel et al. 2007).

Environmental Factors
Sea state and visibility will also influence the likelihood of an interaction between a vessel and a sea turtle. Typically, most vessel operators keep watch for potential obstructions or debris, which can seriously damage or potentially sink a boat. The calmer the sea state, the easier it is to see floating objects, including sea turtles. When the sea state increases and swells are introduced, observing floating obstructions gets increasingly difficult. However, increased sea state will also compel most vessels on the water to decrease speed, which would reduce the risk of a strike and potentially the severity of a strike. Also, generally fewer recreational vessels go on trips in rough conditions, in comparison with calm seas. Thus, there may be a seasonal component to the magnitude of vessel strike risks to sea turtles in some areas. Another factor is traveling east or west during a rising or setting sun; this can dramatically limit forward visibility and inhibit an operator from avoiding a floating sea turtle or other obstruction.

Vessel Traffic and Sea Turtle Abundance
Areas with high concentrations of vessel traffic and high concentrations of sea turtles are expected to have a higher probability and frequency of vessel strikes than areas where vessels and/or sea turtles are less abundant. Data on offshore vessel traffic is still largely absent, but several recent studies have explored the issue of vessel traffic for a few coastal counties in Florida (Sidman et al. 2005, Sidman et al. 2007). The available information indicates that there is extensive traffic in inshore and nearshore waters, particularly around inlets. Additionally, there are latitudinal changes in peak use and average number of trips, with a longer peak season and higher number of monthly trips in southern counties when compared to northern counties.

5.5.1.3 Estimating Sea Turtle Vessel Strikes Attributed to Reef Fish Vessels

It is difficult to definitively evaluate the potential risk to sea turtles stemming from specific vessel traffic from any action because of the numerous variables discussed in Section 5.5.1.2 that may impact vessel strike rates. This difficulty is compounded by a general lack of information on vessel use trends, particularly in regard to offshore vessel traffic. Available data are insufficient to account for such differences in our analysis. However, the following analysis is intended to provide a gross estimate of the potential impact reef fish vessels may have on sea turtles, taking a reasoned approach to conservatively account for vessel impacts based on the best available information.

The Florida Sea Turtle Stranding and Salvage Network (FLSTSSN) has documented 25,290 Florida stranding records (all species and size classes) in their database from 1980 through 2005 (Foley et al. 2008). Although the cause of death was not usually determined for stranded sea turtles because most carcasses (about 70 percent) were at least moderately decomposed, the most common readily observable potential mortality factor was propeller wounds. From 1980 through 2005, there were 3,586 sea turtle stranding records in Florida with definitive propeller injury (1,222 green, 92 leatherback, 2,056 loggerhead, 187 Kemp’s ridley, and 29 hawksbill sea turtles). By species, the percent occurrence of propeller wounds was 34 percent green, 3 percent leatherback, 57 percent loggerhead, 5 percent Kemp’s ridley, and 1 percent hawksbill sea turtles. Many of these specimens may have been dead, sick, or lethargic when struck by a vessel. Of the 3,586 sea turtles with propeller wounds, Foley et al. (2008) determined that 1,086 (30 percent) were wounded by a propeller prior to death, including: (1) 440 sea turtles that were alive when discovered, (2) 22 sea turtles that were determined via necropsy to have been hit prior to death because of the presence of clotted blood, infection, or healing, and (3) 624 sea turtles that were fresh dead when found.

Foley et al. (2008) also noted 703 records of sea turtle strandings in Florida from 1980 through 2005 with major, crushing injuries evident, but no discernible propeller wounds. The sources of these crushing injuries were unknown, but could have been a result of collisions with vessel hulls or engines, fishing gear impacts (e.g., trawl doors), and/or dredging impacts.

In a January 12, 2009, memorandum from Michael Barnette, SERO fishery biologist, to David Bernhart, SERO Assistant Regional Administrator for Protected Resources, the potential threats on listed species of vessel traffic related to new dock and /or marina construction were analyzed. In doing so, several different estimates of vessel strike frequency on a by-vessel and by-trip basis with varying degrees of conservatism were presented by using the sea turtle stranding data discussed above in combination with Florida vessel traffic and use trend data under various assumptions. The number of injured or killed sea turtles attributed to vessel strikes was estimated assuming (1) only those strandings definitively known to have been hit pre-mortem were caused by vessels (i.e., 43 sea turtles injured or killed by vessel strikes); (2) all 3,586 stranding records with propeller injuries and the 703 stranding records with crushing injuries were pre-mortem and caused by vessels (i.e., 171 sea turtles injured or killed a year); and (3) the 3,586 stranding records with propeller injuries and the 703 stranding records with crushing injuries were pre-mortem, caused by vessels, and based on Epperly et al. (1999), represent only 7-13 percent of total strandings (i.e., 1,315-2,443 sea turtles injured or killed a year). The minimum and maximum total number of potential vessel trips in Florida waters during the course of a year was estimated based the number of registered vessels in Florida coastal counties in 2007 and an extrapolation of the minimum and maximum average number of trips per vessel per month documented by several Florida county recreational vessel traffic studies (Sidman et al. 2005 and 2007). The total number of potential vessel trips in Florida ranged from 25.6 to 53.1 million trips. Assuming each vessel trip possesses the same likelihood of resulting in a sea turtle strike, based on the best available information, a sea turtle vessel strike was estimated to occur: (1) every 1,235,268 trips under the least conservative approach, (2) every 149,877 trips under a more conservative approach, and (3) every 10,491 to 19,490 trips under the "ultra-conservative" approach.

In 2006, based on MRFSS intercept and phone survey data, there were an estimated 971,852 directed trips for reef fish made by charter and private rental boats in GOM EEZ off Florida. That same year, based on analysis of logbook data, commercial vessels made an additional 8,102 trips. Based on the above vessel strike rates, estimated vessel strikes attributed to the reef fish fishery in 2006 may have been as little as 1 under the least conservative approach to as many as 50 to 100 sea turtles under the most conservative approach.

Barnette did not consider his most conservative approach to be a realistic estimate for considering the potential vessel impact risk associated with typical dock and/or marine construction. He stated that due to the long string of extrapolations, estimates, and assumptions, as well as some other inherent issues with basing conclusions on Florida recreational vessel traffic patterns (i.e., largely nearshore/coastal) with a single, limited study conducted on a North

Carolina commercial fishery operating further offshore, his most conservative approach was intended solely to help define the absolute edges of the envelope for his analysis.

For our purposes (i.e., estimating vessel strikes attributed to reef fish vessels), extrapolating reported strandings using Epperly et al. (1996) in and of itself seems reasonable to us, considering other studies demonstrating similar levels of under-reporting in stranding records due to turtle carcasses not washing ashore (e.g., TEWG 1998). However, the preceding assumption that all stranding records were pre-mortem likely overestimates the number of reported strandings attributed to reef fish vessels. This is because, although it is highly likely that more than 13 percent of records were pre-mortem and directly attributed to being vessel-struck, it is equally likely that at least some sea turtles struck were dead from other causes prior to being struck. Thus, to try and balance these considerations, we believe using the lower estimate of the most conservative method is the most reasonable approach.

The Barnette memorandum's vessel strike analysis used Florida data exclusively; however, vessel strikes are not exclusive to this area. Because sea turtle densities in the Western Gulf may be more than five times lower than in the Eastern Gulf (NMFS SEFSC 2009b), we believe it is inappropriate to apply the same rate to the entire Gulf. Instead, we assumed a linear relationship between sea turtle abundance and vessel strikes and that vessel strike occurrence in the Western Gulf is five times less than off Florida (i.e., a vessel strike every 97,450 trips off the Western Gulf). In 2006, an additional 311,115 directed trips were made to the Gulf EEZ from Alabama, Louisiana, Missisippi, and Texas states combined (N. Farmer, SERO pers.comm; M. Fisher, Texas Parks and Wildlife, pers. comm.). Using our adjusted vessel-strike rate, these trips resulted in approximately three more sea turtle strikes.

In summary, based on our analysis, we estimate a total of 53 sea turtles are injured or killed annually by reef fish vessels. Based on the percent occurrence of strandings with propeller wounds by species, these were 30 loggerhead, 18 green, 3 Kemp's ridley, and 2 leatherback sea turtles, and 1 hawksbill sea turtle.

5.5.2 Effects on Smalltooth Sawfish

Effects on smalltooth sawfish from moving reef fish vessels (i.e., vessels transiting to and from fishing areas and moving during fishing activity) are discountable. Smalltooth sawfish are primarily demersal and do not spend time near the surface of the water; thus, very rarely would they be at risk from moving vessels. Vessels need sufficient water to navigate without encountering the bottom, and when transiting shoal areas with marginal clearance vessels typically transit cautiously (i.e., slowly), thus would not come in contact with smalltooth sawfish, even in more shallow nearshore waters. Reef fish vessels embarking and returning from offshore fishing trips would likely travel via maintained channel waters where interactions would be even more unlikely.

5.6 Summary

Based on our analysis of the effects of the proposed action, commercial bottom longline, commercial vertical line, and recreational vertical line gear have all adversely affected sea turtles and smalltooth sawfish via captures. After evaluating the effects of implementation of the two proposed rulemakings for the continued authorization of the fishery, we believe that the proposed changes to current management will decrease these fisheries' overall effects on loggerhead sea turtles; effects on other sea turtles and smalltooth sawfish are expected to continue at past levels. Table 5.5 summarizes the anticipated effects we expect on a triennial basis.

Table 5.5 Summary of Anticipated Effects Triennially

Species	Commercial Bottom Longline Captures (Mortalities)	Commercial Vertical Line Captures (Mortalities)	Recreational Vertical Line Captures (Mortalities)	Vessel Strikes (all Lethal)	Entire Fishery
Loggerhead	732 (443)[A] 623 (378)[B]	76 (23)	254 (75)	90(90)	1152 (631)[A] 1043 (566)[B]
Kemp's ridley	3 (3)	23 (7)	74 (22)	9 (9)	88 (41)
Green	3 (3)	14 (4)	45 (14)	54 (54)	170 (75)
Leatherback	3 (3)	1 (1)	1 (1)	6 (6)	11 (11)
Hawksbill	3 (3)	1 (1)	1 (1)	3 (3)	8 (8)
Smalltooth sawfish	2 (0)	2 (0)	4 (0)	0 (0)	8 (0)

[A]=anticipated in 2009-2011; [B]=anticipated for all subsequent 3-year periods

6.0 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions reasonably certain to occur within the action area considered in this opinion (i.e., Gulf federal EEZ). 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 Gulf may affect sea turtles and smalltooth sawfish and their habitats. Stranding data indicate sea turtles in Gulf waters die of various natural causes, including cold stunning and hurricanes, as well as human activities, such as incidental capture in state fisheries, ingestion of and/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.

The fisheries described as occurring within the action area (see Sections 3 and 4, the Status of the Species and the Environmental Baseline, respectively) are expected to continue as described into the foreseeable future, concurrent with the Gulf reef fish fishery. Numerous fisheries in state waters along the Gulf coast have also been known to adversely affect threatened and endangered sea turtles and the endangered smalltooth sawfish. The past and present impacts of these fisheries have been discussed in the Environmental Baseline section of this opinion. NMFS is not aware of any proposed or anticipated changes in these fisheries that would substantially change the impacts each fishery has on the sea turtles and smalltooth sawfish covered by this opinion.

In addition to fisheries, NMFS 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 and smalltooth sawfish covered by this opinion. Therefore, NMFS expects that the levels of take of sea turtles and smalltooth sawfish described for each of the fisheries and non-fisheries will continue at similar levels into the foreseeable future.

7.0 Jeopardy Analyses: Effects of the Proposed Action on the 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 any ESA-listed sea turtles or smalltooth sawfish known to interact with the Gulf reef fish fishery. In Section 5, we have outlined how interactions with the Gulf reef fish fishery can affect sea turtles and smalltooth sawfish and the extent of those effects in terms of triennial estimates of the numbers of sea turtles and smalltooth sawfish captured and killed. Now we turn to an assessment of each species' response to this impact, in terms of overall population effects from the estimated take, and whether those effects of the proposed action, in the context of the status of the species (Section 3), the environmental baseline (Section 4), and the cumulative effects (Section 6), will jeopardize the continued existence of any ESA-listed sea turtles or smalltooth sawfish known to interact with the Gulf reef fish fishery.

"To 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 the recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). Thus, in making this conclusion for each species, we first look at whether there will be a reduction in the reproduction, numbers, or distribution. Then, if there is a reduction in one or more of these elements, we explore whether it will cause an appreciable reduction in the likelihood of both the survival and the recovery of the species.

7.1 Loggerhead Sea Turtles

The proposed action is anticipated to result in the take of up to 1,152 loggerhead sea turtles, of which 631 are expected to be lethal, for the period 2009 through 2011. After that (i.e., from 2012 forward), the proposed action is anticipated to result in the take of up to 1,043 loggerhead sea turtles triennially, of which 566 are expected to be lethal.

As described in Section 3, the recently published recovery plan for the western North Atlantic population of loggerhead sea turtles established five recovery units, based on a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences. Tissue samples for genetic analysis have been collected from loggerhead sea turtles captured in the reef fish fishery, but results of any genetics testing on their natal origin are pending. However, Bowen et al. (2004) estimated 90.2 percent of loggerheads on Gulf feeding grounds are from the south Florida subpopulation (i.e., the Peninsular Florida Recovery Unit [PFRU]), 5.8 percent are from the northern nesting subpopulation (i.e., the Northern Recovery unit [NRU]), 2.5 percent are from the Yucatán, Mexico subpopulation (i.e., Greater Caribbean Recovery Unit [GCRU]), 0.8 percent are from the northwest Florida (i.e., Northern Gulf Recovery Unit [NGRU]) and 0.3 percent are from the Dry Tortugas subpopulation (i.e. the Dry Tortugas Recovery Unit [DTRU]).

Based on this information, we assume the recovery unit origins of loggerhead captures would be in these same proportions. Thus, of the 566 lethal takes projected for 2012-2014, we estimate approximately 511 would be from the PFRU, 33 would be from the NRU, 15 would be from the GCRU, 5 would be from the NGRU, and 2 would be from the DTRU. These proportions are consistent with the relative sizes of the nesting colonies, and we conclude, based on the available evidence, that none of the recovery units are disproportionately impacted by take in the reef fish fishery. Therefore, our discussion of the impacts of the reef fish fishery will focus on the overall western North Atlantic population of loggerhead turtles, which comprises those recovery units.

The non-lethal loggerhead sea turtle takes from the proposed action are not expected to have any measurable impact on the numbers, reproduction, or distribution of loggerhead sea turtles. We have applied the post-release mortality criteria conservatively to ensure that sea turtles that are likely to be seriously injured by capture in the fisheries are counted as lethal takes. The anticipated non-lethal takes are not expected to impact the reproductive potential, fitness, or growth of any of the captured sea turtles because they will be released unharmed shortly after capture, or released with only minor injuries from which they are expected to recover. Individual takes may occur anywhere in the action area and turtles would be released within the general area where they are caught.

The lethal take of up to 631 loggerhead sea turtles from the Gulf from 2009 through 2011, and up to 566 loggerheads triennially thereafter, is a reduction in numbers. These lethal takes would also result in a future reduction in reproduction as a result of lost reproductive potential, as some of these individuals are females who would have survived other threats and reproduced in the future, thus eliminating each female individual's contribution to future generations. For example, an adult female loggerhead sea turtle can lay 3 or 4 clutches of eggs every 2 to 4 years, with 100 to 130 eggs per clutch. The annual loss of adult female sea turtles, on average, could preclude the production of thousands of eggs and hatchlings of which a small percentage would be expected to survive to sexual maturity. A reduction in the distribution of loggerhead sea turtles is not expected from lethal takes attributed to the Gulf reef fish fishery. Because all the potential takes are expected to occur at random throughout the proposed action area and sea turtles generally have large ranges in which they disperse, the distribution of loggerhead sea turtles in the Gulf is expected to be unaffected.

Whether or not the reductions in loggerhead sea turtle numbers and reproduction attributed to the Gulf reef fish fishery would appreciably reduce its likelihood of survival depends on what effect these reductions in numbers and reproduction would have on overall population sizes and trends, i.e., whether the estimated reductions, when viewed within the context of the environmental baseline and status of the species, are to such extent that adverse effects on population dynamics are appreciable. In Section 3.1, we reviewed the status of the species in terms of nesting and female population trends and several recent assessments based on population modeling (i.e., Conant et al. 2009 and NMFS SEFSC 2009d). Below we synthesize what that information means in general terms and also in the more specific context of the Gulf reef fish fishery.

Loggerhead sea turtles are slow growing, long-lived species. Because of their longevity, loggerhead sea turtles require high survival rates throughout their life to maintain a population. In other words, long-lived species cannot tolerate much anthropogenic mortality without going into decline. Conant et al. (2009) concluded loggerhead natural growth rates are small; natural survival needs to be high; and even low to moderate mortality can drive the population into decline. Because recruitment to the adult population is slow, population modeling studies suggest even small increased mortality rates in adults and sub-adults could impact substantially on population numbers and viability (Crouse et. al. 1987; Crowder, et. al. 1994 Heppell et. al. 1995; Chaloupka and Musick 1997).

The best available information indicates the western North Atlantic loggerhead sea turtle population is still large, but is experiencing more mortality than it can withstand. All of the results of recent population models in both NMFS SEFSC (2009d) and Conant et al. (2009) indicated western North Atlantic loggerheads are likely to continue to decline in the future unless action is taken to reduce anthropogenic mortality.

There are multiple sources of mortality affecting loggerhead sea turtles, and anthropogenic mortality on the species occurs at every life stage, although the exact magnitude of the mortality is often unknown. TEWG (2009) indicates it is likely that several factors compound to create the loggerhead decline.

With multiple sources of mortality, there need to be broad-based reductions in mortality across these multiple sources. Actions have been taken to reduce anthropogenic impacts to loggerhead sea turtles from various sources, particularly since the early 1990s. These include lighting ordinances, predation control, and nest relocations to help increase hatchling survival, as well as measures to reduce the mortality of loggerhead pelagic and benthic juveniles and adults in various fisheries and other marine activities.

Conant et al. (2009) concludes the results of its models (i.e., predicted continued declines) are largely driven by mortality of juvenile and adult loggerheads from fishery bycatch that occurs throughout the North Atlantic Ocean. While significant progress has been made to reduce bycatch in some fisheries in certain parts of the loggerhead's range, serious bycatch problems remain unaddressed.

The Gulf Council and SERO are proposing to substantially reduce effort in the bottom longline component of the reef fish fishery and thus substantially reduce mortality attributed to the Gulf reef fish fishery on loggerhead sea turtles. The proposed action limits would reduce the bottom longline fleet to half its recent size and limit the future bottom longline participation by season and area restrictions and gear limitations. The proposed management regime would reduce lethal takes of loggerhead sea turtles in the bottom longline component of the Gulf reef fish fishery from 942 triennially to 378 triennially with full implementation of Amendment 31; this is a 60 percent reduction in mortality. Total, triennial, loggerhead mortality attributed to the proposed action is expected to be reduced from 1130 lethal takes in the past to 566 lethal takes with full implementation of Amendment 31. Thus, this is a 50 percent reduction in the fishery's overall impact on loggerhead sea turtles.

The question we are left with, then, is whether the remaining takes are too much, given the current status of the species and predicted population trajectories. Even though the proposed action includes a significant reduction in the reef fish fishery's impacts on loggerhead turtles, we must evaluate whether the remaining effects of the fishery, proposed to continue into the future and considered in context of the environmental baseline and cumulative effects, are expected to appreciably reduce the likelihood of both the survival and the recovery of loggerhead turtles in the wild. To try to answer this question, we considered the scope of fishery impacts from a couple different approaches. We looked at total population size relative to anticipated take levels. We also looked at the effect on adult mortality rates relative to overall mortality rates.

In our discussion, we will focus solely on female loggerheads. There is no evidence to suggest, nor reason to suspect, that the reef fish fishery affects males and females differentially. Thus, focusing on the more reproductively important females appropriately simplifies our evaluation. In addition, adult females are the population segment with the most precise and accurate population estimates, based on nest counts. We will also focus solely on lethal takes, as we believe the non-lethal takes from the fishery do not affect numbers, reproduction, or distribution of the species.

Of the loggerheads taken in the fishery, we estimated 45 percent would be adults, with a 50:50 male/female ratio, and the rest would be benthic juveniles with a 30:70 male/female ratio. These estimates were based on the sizes observed in the bottom longline component of the Gulf reef fish fishery and the male/female ratios by age class reported in TEWG (2009). (The 45 percent adult proportion is quite high compared to the proportion of adults in the overall population; we consider using this value to be conservative, since it is primarily based on visually estimated (rather than measured) lengths, and because we are applying it to estimated lethal takes from other fishery sectors which are unlikely to encounter such a high proportion of adults.) Thus, our estimated baseline impacts from the fishery prior to 2009 were 85 adult females and 145 benthic juvenile females being killed annually. For the period 2009-2011, annual lethal impacts are estimated to be 47 adult females and 81 benthic juvenile females. Thereafter, annual lethal impacts decline slightly further to 42 adult females and 73 benthic juvenile females. In our discussion of population level effects below, we will focus on the long-term impact levels (i.e., projected take levels for 2011 onward). Although a few more turtles will be killed in the first triennial period than thereafter, the difference is quite small, and we believe the ongoing take level to be of greatest concern.

Lethal Takes Relative to Population Size

NMFS SEFSC (2009d) estimated the minimum adult female population size for the western North Atlantic subpopulation in the 2004-2008 time frame to likely be between 20,000 to 40,000 (median 30,050) female individuals, with a low likelihood of being as many as 70,000 individuals. Estimates were based on the following equation: Adult females = (nests/(nests per female)) x remigration interval. The estimate of western North Atlantic adult loggerhead female was considered conservative for several reasons. The number of nests used for the western North Atlantic was based primarily on U.S. nesting beaches. Thus, the results are a slight underestimate of total nests because of the inability to collect complete nest counts for many non-U.S. nesting beaches. In estimating the current population size for adult nesting female loggerhead sea turtles, NMFS SEFSC (2009d) simplified the number of assumptions and reduced uncertainty by using the minimum total annual nest count over the last five years (i.e., 48,252 nests). This was a particularly conservative assumption considering how the number of nests and nesting females can vary widely from year to year, (cf., 2008's nest count of 69,668 nests, which would have increased the adult female estimate proportionately, to between 30,000 and 60,000). Also, minimal assumptions were made about the distribution of remigration intervals and nests per female parameters, which are fairly robust and well known parameters.

Although not in NMFS SEFSC (2009d), NMFS SEFSC, in conducting its loggerhead assessment also produced a much less robust estimate for total benthic females in the western North Atlantic, with a likely range of approximately 60,000 to 700,000, up to less than one million. This estimate was discussed during the SEFSC's presentation on the loggerhead assessment to the Gulf Council's Reef Fish Committee at its June 16, 2009, meeting (NMFS SEFSC 2009c). The estimate of overall benthic females is considered less robust because it is model-derived, assumes a stable age/stage distribution, and is highly dependent upon the life history input parameters. Relative to the more robust estimate of adult females, this estimate of total benthic female population is consistent with our knowledge of loggerhead life history and the relative abundance of adults and benthic juveniles: the benthic juvenile population is an order of magnitude larger than adults. Therefore, we believe female benthic loggerheads number in the hundreds of thousands.

For the western North Atlantic population, the anticipated long-term deaths resulting from the fishery (i.e., 42 females annually) represent the removal of approximately 0.14 percent of the estimated adult loggerhead female population. For benthic juvenile females, the anticipated deaths of 73 annually represent a maximum of 0.12 percent to a minimum of 0.010 percent of the estimated total population.

Relative Contribution to Overall Mortality Rate

The relatively precise and conservative estimate of total adult female population size, now available to us in NMFS SEFSC (2009d), allows us to quantitatively assess the contribution of a particular mortality source to the species' overall mortality rate. Annual survival rates have been estimated for adult female loggerheads in the western North Atlantic in several studies [see TEWG (2009) for a summary]. Annual mortality rates are simply one minus the annual survival rate. Using the median value for minimum adult female population size from NMFS SEFSC (2009d) – 30,050 – the fraction of the total mortality rate represented by the estimated adult female deaths from the reef fish fishery is 0.001412. NMFS SEFSC (2009d), drawing from the survival rates in TEWG (2009) and Hedges (2007), identified low, nominal, and high values for western North Atlantic adult female loggerheads, based on the range of recent empirical estimates. As NMFS SEFSC 2009(d) emphasized there is significant uncertainty in the ranges of their life history parameters, including survival and mortality rates. Loggerhead survival values ranged from 0.770 to 0.925, with a nominal value of 0.841. The corresponding mortality rates range from 0.230 to 0.075. The difference between these high and low values represents our current ability to resolve overall mortality for adult female loggerheads. The contribution of the reef fish fishery to the overall mortality rate is, thus, less than one one-hundredth of our ability to assess mortality rates for the adult female population [0.001412/(0.230-0.075) = 0.0091]. Using a less conservative population estimate would make the relative contribution even smaller.

We did not attempt a similar analysis of contribution to overall mortality rate for benthic juvenile females for several reasons. First, our estimate of juvenile population size is relatively much more imprecise than for adult females. Second, the range of mortality values is even wider for benthic juveniles than for adults. Third, since adults are impacted proportionately more by the reef fish fishery than juveniles, the contribution to juvenile mortality rates would also, logically, be less. We thus felt that a numerical comparison of such low, imprecise numbers would not shed additional light on the impact of the fishery, acting through benthic juvenile female mortality.

Consideration of Adult Female Equivalents

While we are relatively confident that focusing our analysis particularly on adult females is appropriate in this case, given their importance and the relatively large portion of adults affected by the reef fish fishery, we wanted to make additional efforts to assess impacts through loss of juveniles as well. Because loggerheads' juvenile life stage is so long and the population is so large, it is challenging to numerically assess their value. A simplifying approach is to apply a correcting relative reproductive value associated with the life stage. Multiplying the number of benthic juvenile females times the relative reproductive value for the stage produces a value called "adult female equivalents." NMFS and USFWS (2009) used a value of 0.235 for neritic zone juveniles. We use that value here, transforming our annual estimated benthic juvenile deaths resulting from the fishery, 73, into 17 adult female equivalents. Adding in the actual adults, the annual impact of the fishery is estimated to be 60 adult female equivalents.

By comparison, a similar approach was used by Merrick and Haas (2008) to transform loggerhead bycatch that was predominantly juveniles into "adults" so they could be assessed against an all-adults population model. [Minor notable differences between our approach and Merrick and Haas is our use of the lower, but more recent, relative reproductive value from NMFS and USFWS (2009) vs. their use of 0.32 from Wallace et al. (2008) and their exclusion of non-U.S. origin turtles vs. our consideration of all western North Atlantic recovery units.] In that instance Merrick and Haas (2009) reported that eliminating the fishery bycatch mortality of 102 adult female equivalents did not change the calculated risk of extinction of the population of adult female western North Atlantic loggerheads over the next 100 years. Without re-running their model, we can still conclude that this finding would certainly apply to the lower fishery bycatch of 60 adult female equivalents. We do note, however, that Merrick and Haas's model predicts continued long-term declines, like NMFS SEFSC (2009d) and Conant et al. (2009), and also predicts quasi-extinction of loggerheads in about two centuries, if mortality is not reduced. Merrick and Has (2009) found the effect of eliminating the mortality of 102 adult female equivalents was to increase median time to extinction by an additional 33 years.

Effects on Likelihood of Survival and Recovery

The NMFS and USFWS' ESA Section 7 Handbook (USFWS and NMFS 1998) provides further definition for *survival* and *recovery*, as they apply to the ESA's jeopardy standard.

> *Survival* means: the species' persistence… beyond the conditions leading to its endangerment, with sufficient resilience to allow recovery from endangerment. Said another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficiently large population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter.
>
> *Recovery* means: improvement in the status of a listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the Act. Said another way, recovery is the process by which species' ecosystems are restored and/or threats to the species are removed so self-sustaining and self-regulating populations of listed species can be supported as persistent members of native biotic communities.

The Services' recovery plan for the Northwest Atlantic population of the loggerhead turtle (NMFS and USFWS 2009) provides additional explanation of the goals and vision for recovery for this population. The objectives of the recovery plan most pertinent to the threats posed by the reef fish fishery are numbers 1, 10, 11, and 13:

1. Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females….
10. Minimize bycatch in domestic and international commercial and artisanal fisheries.
11. Minimize trophic changes from fishery harvest and habitat alteration….
13. Minimize vessel strike mortality.

The recovery plan anticipates that, with implementation of the plan, the western North Atlantic population will recover within 50 to 150 years, but notes that reaching recovery in only 50 years would require a rapid reversal of the current declining trends of the Northern, Peninsular Florida, and Northern Gulf of Mexico Recovery Units. The recovery plan includes one recovery action that is particularly relevant to the proposed action of this opinion:

> Promulgate regulations to implement proven measures that minimize loggerhead interactions with commercial pelagic and demersal longline fisheries. Enforceable bycatch reduction measures, which include proven and specific gear modifications, time/area closures, and/or changes in fishing practices, should be implemented by regulation. Regulations must be specific and enforceable.

The multiple recent reviews and assessments of loggerheads (e.g., NMFS and USFWS 2008, Merrick and Haas 2008,Witherington et al. 2009, TEWG 2009, Conant et al. 2009, and NMFS SEFSC 2009d) have all concluded that loggerhead nesting and adult female populations in the western North Atlantic are in decline and likely to continue to decline. As discussed in Section 3 and TEWG (2009), there is conflicting information of increases of abundance in some juvenile age class, which makes an assessment of overall population trends more difficult. The population is clearly not at a stable age distribution, given past population perturbations; and it is possible that observed declines may be transitory effects, which will be compensated for by a wave of recruitment. However, the most comprehensive demographic model to date (NMFS SEFSC 2009d) also predicts that a continued decline in the total population is likely, given our present knowledge of loggerhead life history parameters. Therefore, we believe a conservative assessment of the western North Atlantic population is that the population is in overall decline. We concur with TEWG (2009) that many factors are responsible for past and present loggerhead mortality that are impacting current nesting declines; however, we also concur with Conant et al. (2009) that fisheries bycatch is likely the largest contributor to western North Atlantic loggerhead mortality, though the relative contribution of past vs. present fisheries bycatch mortality in the current decline is not clear.

Despite the recently seen decline of the western North Atlantic population, its total population remains large. Adult female population size is conservatively estimated, based on the minimum nesting year of 2007, in the range of 20,000 to 40,000. The adult male population would be similar. Benthic juveniles number into the hundreds of thousands, maybe over a million, including males and females. Nesting in Florida has declined by 43-44 percent from 1998 to 2007 (Witherington et al. 2009), but this is a decline from the maximum nesting level recorded for this population in 1998.

As discussed above, the anticipated long-term deaths resulting from this action represent the removal of approximately 0.14 percent of the estimated adult loggerhead female population. For benthic juvenile females, the anticipated deaths of 73 annually represent a maximum of 0.12 percent to a minimum of 0.010 percent of the estimated total population. These removals are very small and contribute only minimally to the overall mortality on the population. For adult females, the incremental effect on annual mortality rates is less than one one-hundredth of the range of possible mortality values for the species. For benthic juvenile females, the contribution to overall mortality is less. Because this contribution to mortality is a tiny part of our range of uncertainty across what total mortality might be, we do not believe that the small effect posed by the lethal takes in this fishery will be detectable or appreciable.

We believe that the incidental take and resulting mortality of loggerhead turtles associated with the proposed action are not reasonably expected to cause an appreciable reduction in the likelihood of survival of the western North Atlantic population of loggerhead turtles. As stated previously, the proposed action is expected to result in the annual mortality of 60 adult female equivalents. We believe the currently still large population is likely to continue to decline until large mortality reductions in all fisheries and other sources of mortality (including impacts outside U.S. jurisdiction) are achieved. However, over at least the next several decades, we expect the western North Atlantic population to remain large (tens or hundreds of thousands of individuals) and to retain the potential for recovery. The effects of the proposed action will most directly affect the overall size of the population, which we believe will remain sufficiently large for several decades to come, and the action will not cause the population to lose genetic heterogeneity, broad demographic representation, or successful reproduction, nor affect loggerheads' ability to meet their lifecycle requirements, including reproduction, sustenance, and shelter.

We believe that the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of recovery of the western North Atlantic population of loggerhead turtles. Recovery is the process of removing threats so self-sustaining populations persist in the wild. Elements of the proposed action support or implement the Service's recovery plan developed for the Northwestern Atlantic population of the loggerhead sea turtle (NMFS and USFWS 2008). The proposed action does not retard progress on carrying out any aspect of the recovery program or achieving the overall recovery strategy. The recovery plan estimates that the population will reach recovery in 50 to 150 years, as recovery actions are implemented. The minimum end of the range assumes a rapid reversal of the current declining trends; the higher end assumes that additional time will be needed for recovery actions to bring about population growth.

The regulatory measures of the proposed action directly support the recovery process and the recovery plan's objective 10, "Minimize bycatch in domestic and international commercial and artisanal fisheries." They also implement a particular action within the recovery plan, with respect to the bottom longline sector: "Promulgate regulations to implement proven measures that minimize loggerhead interactions with commercial pelagic and demersal longline fisheries."

We believe the proposed action does not conflict with objective 11, "Minimize trophic changes from fishery harvest and habitat alteration," because we doubt loggerhead turtles prey significantly upon any target species harvested in the reef fish fishery, and because any habitat alterations caused by bottom longline gear in loggerhead foraging grounds will be minimized by this action through reduction of the fleet to half its recent size, seasonal area closures, and gear limitations.

The proposed action supports recovery objective 13, "Minimize vessel strike mortality." The recovery plan has a rather general action associated with this objective, "Develop and implement a strategy to reduce vessel interactions with loggerheads." This opinion is the first to address recreational vessel strikes as a significant effect of fishery operations, and it will include reasonable and prudent measures to help carry out this recovery action, as it relates to the Gulf reef fish fishery.

Recovery objective 1, "Ensure that the number of nests in each recovery unit is increasing…," is the plan's overarching objective and has associated demographic criteria. Currently, none of the plan's criteria are being met, but the plan acknowledges that it will take 50-150 years to do so. Further reduction of multiple threats throughout the North Atlantic, Gulf of Mexico, and Greater Caribbean will be needed for strong, positive population growth, following implementation of more of the plan's actions. Although any continuing mortality in an already declining population can affect the potential for population growth, we believe the size of the effect posed by the incidental take and mortality of loggerhead turtles resulting from the proposed action is so small that it is not an appreciable reduction in the likelihood of a recovery that is not anticipated for 50-150 years.

Conclusion

In conclusion, we believe that the lethal and non-lethal takes of loggerhead sea turtles associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of both the survival and recovery of the western North Atlantic population of the loggerhead sea turtle in the wild. Although any level of take and mortality theoretically has a negative effect on the overlying population, we believe the take and mortality associated with the proposed action, relative to the magnitude of other impacts and the population's large size, are not detectable. The proposed action is decreasing collective baseline impacts which are contributing to the population's recent decline, by substantially decreasing estimated total takes and mortalities in the Gulf of Mexico reef fish fishery. Even with the species' decline, the remaining impacts from the continued authorization of the fishery will not appreciably affect the population's persistence into the future or its potential for recovery.

7.2 Green Sea Turtles

The proposed action may result in 170 green sea turtle takes (75 lethal, 95 non-lethal) over consecutive 3-year periods.

The potential non-lethal take of 95 green sea turtles over consecutive 3-year periods is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. The individuals are expected to fully recover such that no reductions in reproduction or numbers of green sea turtles are anticipated. Since the takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of green sea turtles is anticipated.

The potential lethal take of 75 green sea turtles over consecutive 3-year periods would reduce the number of green sea turtles, compared to their numbers in the absence of the proposed action, assuming all other variables remained the same. Lethal takes could also result in a potential reduction in future reproduction, assuming the individuals were females and would have survived to reproduce. For example, an adult green sea turtle can lay 1-7 clutches (usually 2-3) of eggs every 2 to 4 years, with 110-115 eggs/nest. The loss of 73 adult female sea turtles, on average, could preclude the production of thousands of eggs and hatchlings, of which a fractional percentage are expected to survive to sexual maturity. The anticipated takes are expected to occur anywhere in the action area and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of green sea turtles is expected from these takes.

Whether the reductions in numbers and reproduction of these species would appreciably reduce their likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

The 5-year status review for green sea turtles states that of the seven green sea turtle nesting concentrations in the Atlantic Basin for which abundance trend information is available, all were determined to be either stable or increasing (NMFS and USFWS 2007a). That review also states that the annual nesting female population in the Atlantic basin ranges from 29,243-50,539 individuals. Additionally, the pattern of green sea turtle nesting shows biennial peaks in abundance, with a generally positive trend during the ten years of regular monitoring since establishment of index beaches in Florida in 1989. An average of 5,039 green turtle nests were laid annually in Florida between 2001 and 2006 with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a).

Although the anticipated mortalities would result in an instantaneous reduction in absolute population numbers, the U.S. populations of green sea turtles would not be appreciably affected. For a population to remain stable, sea turtles must replace themselves through successful reproduction at least once over the course of their reproductive lives, and at least one offspring must survive to reproduce itself. If the hatchling survival rate to maturity is greater than the mortality rate of the population, the loss of breeding individuals would be replaced through recruitment of new breeding individuals from successful reproduction of non-taken sea turtles. Since the abundance trend information for green sea turtles is either stable or increasing, we believe the loss of 75 green turtles over consecutive 3-year periods will not have any measurable effect on that trend.

Based on the above analysis, we believe the proposed action is not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of the green sea turtle in the wild.

Although no change in distribution was concluded for green sea turtles, we concluded lethal takes would result in a reduction in absolute population numbers that may also reduce reproduction, but these reductions are not expected to appreciably reduce the likelihood of survival of green sea turtles in the wild. The following analysis considers the effects of the anticipated take on the likelihood of recovery in the wild.

The Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991b) lists the following relevant recovery objectives over a period of 25 continuous years:

- The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years;
    - Green turtle nesting in Florida over the past six years has been documented as follows: 2001 – 581 nests, 2002 – 9,201 nests, 2003 – 2,622, 2004 – 3,577 nests, 2005 – 9,644 nests, and 2006 – 4,970 nests. This averages 5,039 nests annually over the past 6 years (NMFS and USFWS 2007a).
- A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.
    - Several actions are being taken to address this objective; however, there are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds.

The potential lethal take of 75 green sea turtles over consecutive 3-year periods is not likely to reduce population numbers over time due to current population sizes and expected recruitment. Non-lethal takes of sea turtles would not affect the adult female nesting population or number of nests per nesting season. Additionally, our estimate of future take is based on our belief that the same level of take occurred in the past. It is worth noting that this level of take has already occurred in the past, yet we have still seen positive trends in the status of this species. Thus, the proposed action is not in opposition to the recovery objectives above and will not result in an appreciable reduction in the likelihood of green sea turtles' recovery in the wild.

7.3 Hawksbill Sea Turtles

The proposed action may result in up to eight hawksbill sea turtle takes (all lethal) over consecutive 3-year periods.

The lethal take of up to eight hawksbill sea turtles over consecutive 3-year periods would reduce the number of hawksbill sea turtles, compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. These lethal takes could also result in a reduction in future reproduction, assuming the individual was a female and would have survived to reproduce in the future. For example, an adult hawksbill sea turtle can lay 3-5 clutches of eggs every few years (Meylan and Donnelly 1999, Richardson et al. 1999) with up to 250 eggs/nest (Hirth 1980). Thus, the loss of one adult female sea turtle, on average, could preclude the production of thousands of eggs and hatchlings, of which a fractional percentage is expected to survive to sexual maturity. Thus, the death of a female eliminates that individual's contribution to future generations, and the action will result in a reduction in sea turtle reproduction. The anticipated takes are expected to occur anywhere in the action area and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of hawksbill sea turtles is expected from these takes.

Although no change in distribution was concluded for this, we concluded lethal takes would result in a reduction in absolute population numbers that may also reduce reproduction, but these reductions are not expected to appreciably reduce the likelihood of survival of any species in the wild. The following analysis considers the effects of the anticipated take on the likelihood of recovery in the wild.

The Recovery Plan for the population of the hawksbill sea turtles (NMFS and USFWS 1993) lists the following relevant recovery objectives over a period of 25 continuous years:

- The adult female population is increasing, as evidenced by a statistically significant trend in the annual number of nests at five index beaches, including Mona Island and Buck Island Reef National Monument.
    - Of the rookeries regularly monitored: Jumby Bay (Antigua/Barbuda), Barbados, Mona Island, and Buck Island Reef National Monument all show increasing trends in the annual number of nests (NMFS and USFWS 2007b).
- The numbers of adults, subadults, and juveniles are increasing, as evidenced by a statistically significant trend on at least five key foraging areas within Puerto Rico, USVI, and Florida.
    - In-water research projects at Mona Island, Puerto Rico, and the Marquesas, Florida, which involve the observation and capture of juvenile hawksbill turtles, are underway. Although there are 15 years of data for the Mona Island project, abundance indices have not yet been incorporated into a rigorous analysis or a published trend assessment. The time series for the Marquesas project is not long enough to detect a trend (NMFS and USFWS 2007b).

The potential lethal take of eight hawksbill sea turtles over consecutive 3-year periods is not likely to reduce population numbers over time due to current population sizes and expected recruitment. Additionally, our estimate of future take is based on our belief that the same level of take occurred in the past. It is worth noting that this level of take has already occurred in the past, yet we have still seen positive trends in the status of these species. Thus, we believe the proposed action is not in opposition to the recovery objectives above and will not result in an appreciable reduction in the likelihood of hawksbill sea turtles' recovery in the wild.

7.3 Kemp's Ridley Sea Turtles

The proposed action may result in up to 88 Kemp's ridley sea turtle takes, 47 non-lethal and 41 lethal, during consecutive 3-year periods.

The non-lethal takes of 47 Kemp's ridley sea turtles every three years is not expected to have any measurable impact on the reproduction, numbers, or distribution of this species. The individuals are expected to fully recover such that no reductions in reproduction or numbers of this species are anticipated. Since these takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of Kemp's ridley sea turtles is anticipated.

The lethal take of up to 41 Kemp's ridley sea turtles every three years would reduce the species' population compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. These 41 lethal takes could also result in a potential reduction in future reproduction, assuming at least some of these individuals would be female and would have survived to reproduce in the future. The annual loss of adult female sea turtle, on average, could preclude the production of thousands of eggs and hatchlings, of which a fractional percentage is expected to survive to sexual maturity. Thus, the death of any females would eliminate their contribution to future generations, and result in a reduction in sea turtle reproduction. The anticipated takes are expected to occur anywhere in the action area and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of Kemp's ridley sea turtles is expected from the take of these individuals.

Whether the reductions in numbers and reproduction of these species would appreciably reduce their likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

The total population of Kemp's ridley sea turtles is not known, but nesting has been increasing significantly in the past several years (9 to 13 percent per year) with preliminary estimates for 2008 of over 17,000 nests (S. Epperly, SEFSC, pers. comm. 2008). Kemp's ridleys mature and nest at an age of 7-15 years, which is earlier than other chelonids. A younger age at maturity may be a factor in the response of this species to recovery actions. 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. The increased survivorship of immature sea turtles is largely attributable to the introduction of turtle excluder devices (TEDs) in the United States and Mexican shrimping fleets and Mexican beach

protection efforts. The TEWG (2000) projected that Kemp's ridleys could reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015.
The potential lethal take of 41 Kemp's ridley sea turtles over consecutive 3-year periods is not likely to reduce population numbers over time due to current population sizes and expected recruitment. Non-lethal takes of sea turtles would not affect the adult female nesting population or number of nests per nesting season. Additionally, our estimate of future take is based on our belief that the same level of take occurred in the past. It is worth noting that this level of take has already occurred in the past, yet we have still seen positive trends in the status of these species. Thus, we believe the proposed action is not in opposition to the recovery objectives above and will not result in an appreciable reduction in the likelihood of Kemp's ridley sea turtles' recovery in the wild.

7.4 Leatherback Sea Turtles

The proposed action may result in up to 11 leatherback sea turtle takes (all lethal) during consecutive 3-year periods.

The lethal take of up to 11 leatherback sea turtles every three years would reduce their respective populations by 11, compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. The 9 lethal takes could also result in a potential reduction in future reproduction, assuming one or more of these individuals was a female and would have survived to reproduce in the future. For example, an adult female leatherback sea turtle can produce up to 700 eggs or more per nesting season (Schultz 1975). Although a significant portion (up to approximately 30 percent) of the eggs can be infertile, the annual loss of adult female sea turtles, on average, could preclude the production of thousands of eggs and hatchlings of which a small percentage would be expected to survive to sexual maturity. Thus, the death of as many as 9 females would eliminate those individuals contribution to future generations, and the action will result in a reduction in sea turtle reproduction. The anticipated takes are expected to occur anywhere in the action area and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of leatherback sea turtles is expected from the take of an individual.

Whether the estimated reductions in numbers and reproduction of these species would appreciably reduce their likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

The Leatherback Turtle Expert Working Group estimates there are between 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) in the North Atlantic. Of the five leatherback populations or groups of populations in the North Atlantic, three show an increasing or stable trend (Florida, Northern Caribbean, and Southern Caribbean,). This includes the largest nesting population, located in the Southern Caribbean at Suriname and French Guiana. Of the remaining two populations, there is not enough information available on the West African population to conduct a trend analysis, and, for the Western Caribbean, a slight decline in annual population growth rate was detected (TEWG 2007).[12]

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[12] An annual growth rate of 1.0 is considered a stable population; the growth rates of two nesting populations in the Western Caribbean were 0.98 and 0.96 (TEWG 2007).

Although the 11 anticipated mortalities would result in a reduction in absolute population numbers, it is not likely this small reduction would appreciably reduce the likelihood of survival of either of these sea turtle species. If the hatchling survival rate to maturity is greater than the mortality rate of the population, the loss of breeding individuals would be replaced through recruitment of new breeding individuals from successful reproduction of non-taken sea turtles. Considering that nesting trends for the Florida and Northern Caribbean populations and the largest nesting population, the Southern Caribbean population, are all either stable or increasing, we believe the loss of up to 11 leatherback sea turtles every three years will not have any measurable effect on overall population trends.

Based on the above analysis, we believe the proposed action is not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of these species of sea turtles in the wild.

The Atlantic recovery plan for the U.S. population of the leatherback sea turtles (NMFS and USFWS 1992) lists the following relevant recovery objective:

- The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico; St. Croix, USVI; and along the east coast of Florida.
    - In Puerto Rico, the main nesting areas are at Fajardo on the main island of Puerto Rico and on the island of Culebra. Between 1978 and 2005, nesting increased in Puerto Rico from a minimum of 9 nests recorded in 1978 and to a minimum of 469-882 nests recorded each year between 2000 and 2005. Annual growth rate was estimated to be 1.1 with a growth rate interval between 1.04 and 1.12, using nest numbers between 1978 and 2005 (NMFS and USFWS 2007d).
    - In the U.S. Virgin Islands, researchers estimated a population growth of approximately 13 percent per year on Sandy Point National Wildlife Refuge from 1994 through 2001. Between 1990 and 2005, the number of nests recorded has ranged from 143 (1990) to 1,008 (2001). The average annual growth rate was calculated as approximately 1.10 (with an estimated interval of 1.07 to 1.13) (NMFS and USFWS 2007d).
    - In Florida, a Statewide Nesting Beach Survey program has documented an increase in leatherback nesting numbers from 98 (1989) to 800-900 (early 2000s). Based on standardized nest counts made at Index Nesting Beach Survey sites surveyed with constant effort over time, there has been a substantial increase in leatherback nesting in Florida since 1989. The estimated annual growth rate was approximately 1.18 (with an estimated 95 percent interval of 1.1 to 1.21) (NMFS and USFWS 2007d).

The potential lethal take of 11 leatherback sea turtles during any consecutive 3-year period is not likely to reduce population numbers over time due to current population sizes and expected recruitment. Additionally, our estimate of future take is based on our belief that the same level of take occurred in the past. It is worth noting that this level of take has already occurred in the past, yet we have still seen stable or increasing trends in the status of the species in most Atlantic populations. Thus, we believe the proposed action is not in opposition to the recovery objectives above and will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild.

7.6 Smalltooth Sawfish

The proposed action is expected to result in the taking of eight large juvenile or adult smalltooth sawfish on a triennial basis, but no mortality is anticipated. The short-term, non-lethal effects anticipated on smalltooth sawfish are therefore not expected to affect the reproduction, numbers, or distribution of wild populations of smalltooth sawfish. The abundance of adults relative to juvenile smalltooth sawfish, including very small individuals, encountered in shallow waters outside of the proposed action area suggests the population remains reproductively active and viable. Based on this information, the Gulf reef fish fishery would not affect the reproduction, numbers, or distribution of wild populations of smalltooth sawfish. Therefore, the proposed action will not reduce the smalltooth sawfish population's likelihood of surviving and recovering in the wild. Thus, NMFS believes that the proposed action is not likely to jeopardize the continued existence of smalltooth sawfish.

8.0 Conclusion

We have analyzed the best available 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 or smalltooth sawfish.

Green, Hawksbill, Kemp's Ridley, Leatherback, and Loggerhead Sea Turtles
Our sea turtle analyses focused on the impacts to and population response of sea turtles in the Atlantic basin. However, the impact of the effects of the proposed action on the Atlantic populations must be directly linked to the global populations of the species, and the final jeopardy analysis is for the global populations as listed in the ESA. Because the proposed action will not reduce the likelihood of survival and recovery of any Atlantic populations of sea turtles, it is our opinion that the continued operation of the Gulf reef fish fishery is also not likely to jeopardize the continued existence of green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtles.

Smalltooth Sawfish
The smalltooth sawfish analyses focused on the impacts and population response of the U.S. DPS of smalltooth sawfish. Based on these analyses, it is our opinion that the continued operation of the Gulf reef fishery is not likely to jeopardize the continued existence of smalltooth sawfish.

9.0 Incidental Take Statement (ITS)

Section 9 of the ESA and protective regulations issued 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 RPAs 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, F/SER2 must immediately notify (within 24 hours, if communication is possible) NMFS's Office of Protected Resources should a take of a listed marine mammal occur.

9.1 Anticipated Amount or Extent of Incidental Take

NMFS anticipates the following incidental takes may occur as a result of the continued operation of the Gulf reef fish fishery. The numbers presented represent total takes over three-year periods. Annual take estimates can have high variability because of natural and anthropogenic variation. As a result, monitoring fisheries using 1-year estimated take levels is largely impractical. It is unlikely that all species evaluated in this opinion will be consistently impacted year after year by every gear type. Some years may have no observed interactions and thus no estimated captures. This makes it easy to exceed average take levels in years when interactions are observed. Based on our experience monitoring fisheries, we believe a three-year time period is appropriate for meaningful monitoring given the frequency of changes in management and the uncertainty of how effort by gear type may shift in response to the proposed action. This approach will allow us to reduce the likelihood of requiring reinitiation unnecessarily because of inherent variability in take levels, but still allow for an accurate assessment of how the Gulf reef fish fishery is performing versus our expectations.

Table 9.1 Anticipated Triennial Takes

Species	Commercial Bottom Longline Takes (Mortalities)	Commercial Vertical Line Takes (Mortalities)	Recreational Vertical Line Takes (Mortalities)	Vessel Strike Takes- All Lethal	Entire Fishery Takes (Mortalities)
Loggerhead	732 (443)[A] 623 (378)[B]	76 (23)	254 (75)	90(90)	1152 (631)[A] 1043 (566)[B]
Kemp's ridley	3 (3)	23 (7)	74 (22)	9 (9)	88 (39)
Green	3 (3)	14 (4)	45 (14)	54 (54)	170 (75)
Leatherback	3 (3)	1 (1)	1 (1)	6 (6)	11 (11)
Hawksbill	3 (3)	1 (1)	1 (1)	3 (3)	8 (8)
Smalltooth sawfish	2 (0)	2 (0)	4 (0)	0 (0)	8 (0)

[A]=anticipated in 2009-2011; [B]=anticipated for all subsequent 3-year periods

9.2 Effect of the Take

The NMFS has determined the level of anticipated take specified in Section 9.1 is not likely to jeopardize the continued existence of green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtles, or smalltooth sawfish.

9.3 Reasonable and Prudent Measures (RPMs)

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

The RPMs and terms and conditions are required, per 50 CFR 402.14 (i)(1)(ii) and (iv), to document the incidental take by the proposed action and to minimize the impact of that take on ESA-listed species. These measures and terms and conditions are non-discretionary, and must be implemented by NMFS for the protection of section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this incidental take statement. If it 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. These requirements remain valid until conclusion of any subsequent opinion on this fishery. To monitor the impact of the incidental take, F/SER2 must report the progress of the action and its impact on the species to F/SER3 as specified in the incidental take statement [50 CFR 402.14(i)(3)].

We have determined that the following RPMs are necessary and appropriate to minimize the impacts of future takes of sea turtles and smalltooth sawfish by the Gulf reef fish fishery and to monitor levels of incidental take.

1. Avoiding and Minimizing Take Through Outreach and Education

In each of our fishery component analyses, we described how gear can adversely affect sea turtles and smalltooth sawfish via hooking, entanglement, trailing line, and/or forced submergence. Section 5.5 describes how moving reef fish vessels are also likely to adversely affect sea turtles via collision impacts or propeller wounds. Most, if not all, sea turtles and smalltooth sawfish released after capture have experienced some degree of physiological injury from forced submergence and/or abrasions/lacerations caused by hooking or entanglement. Experience with other hook-and-line fisheries has shown that the ultimate severity of these events is dependent not only upon the actual capture, but the amount of gear remaining on the animal at the time of release. The handling of an animal also greatly affects its chance of recovery. Therefore, the experience, knowledge, ability, and willingness of fishers to remove gear, is crucial to the survival of sea turtles and smalltooth sawfish following release. Certain behavior by fishermen may also help to reduce the likelihood of takes. For these reasons, NMFS shall conduct outreach and education to ensure that takes are avoided to the extent practicable and sea turtles and smalltooth sawfish are handled in a way that minimizes adverse effects from incidental take and reduces the likelihood of mortality.

2. Minimizing Future Gear Impacts Through Research

Fishing gear and fishing behavior may influence the frequency and severity of interactions with sea turtles and smalltooth sawfish. However, fishing characteristics and behavior vary from vessel to vessel. To achieve a better understanding of how these characteristics differ, and how these differences may affect sea turtles and smalltooth sawfish, NMFS shall conduct research to better characterize the fishery and its interactions with sea turtles and smalltooth sawfish.

3. Monitoring the Frequency, Magnitude, and Impact of Incidental Take

The jeopardy analyses for sea turtles and smalltooth sawfish are based, in part, on the assumption that the frequency, magnitude, and impact of incidental take estimated in this opinion are accurate. While the take estimates and associated effects on listed species are both based on the best available information, many assumptions were made to overcome poor or missing data. If our estimates regarding the frequency and magnitude of incidental take by the commercial and recreational sectors prove to be an underestimate, or the life history parameters of listed species inaccurate, we risk having misjudged the potential adverse effects to these species. Thus, it is imperative that we monitor and track both the level of take occurring specific to the reef fish fishery and the status of listed species. Therefore, NMFS shall ensure that monitoring and reporting of any sea turtles or smalltooth sawfish encountered: (1) detect any adverse effects resulting from the Gulf reef fish fishery; (2) assess the actual level of incidental take in comparison with the anticipated incidental take, (3) detect when the level of anticipated take is exceeded, and (4) collect improved data from individual encounters.

9.4 Terms and Conditions

To be exempt from take prohibitions established by section 9 of the ESA, NMFS must comply with the following terms and conditions, which implement the RPMs described above. These terms and conditions are non-discretionary.

The following terms and conditions implement RPM No. 1.

1. F/SER2, in collaboration with SERO and NMFS staff from other offices and divisions as appropriate, must develop and implement a comprehensive outreach plan to promote that takes be avoided to the extent practicable and that any sea turtle and smalltooth sawfish that are captured are handled in a way that minimize adverse effects from incidental take and reduces the likelihood of mortality. The goal, objectives, strategies, and associated action items of the plan must be included in a written document and be reviewed and updated as needed. Elements of the plan must include, but are not limited to:

    a. Establishment of a point of contact (POC) to answer constituent questions pertaining to sea turtle release gear and safe handling and release protocols. This POC should also actively reach out to fishermen to: (1) learn about their experiences, (2) trouble-shoot problems, and (3) share solutions and successful experiences with other fishermen and NMFS scientist and managers.

b. In-person training and education of commercial and recreational fishermen on: (1) identification of sea turtles species, (2) how to use required and recommended sea turtle gear removal equipment, (3) the "Careful Release and Protocols for Sea Turtle Release with Minimal Injury," and (4) the importance of maximizing gear removal to maximize post-release survival of sea turtles. This requirement may be conducted through voluntary workshops, fishing club meetings, and/or dockside visits by the established POC; additional information pertinent to smalltooth sawfish must be included as appropriate.

c. Increased collaboration and communication with federal and state agency partners (e.g., Sea Grant, Florida Fish and Wildlife Commission, etc.) and in-house expertise in outreach, education, and research to minimize sea turtle and smalltooth sawfish bycatch, bycatch mortality, and vessel strikes.

d. Distribution of training materials to specified reef fish constituents including, but not limited to, the following information.

    i. NMFS must distribute to permit holders with bottom longline endorsements information specifying handling and/or resuscitation requirements fishers must undertake for any sea turtles taken, as stated in 50 CFR 223.206(d)(1-3).

    ii. NMFS must distribute guidelines addressing recreational fishing takes. These guidelines should include the following, or something similar, at a minimum:

        1. Do not leave baited hooks and line unattended. If you are watching you are less likely to catch something you didn't want to.
        2. Keep watch for sea turtles surfacing in the vicinity of where you are fishing. Avoid casting in the direction of any sighted sea turtles to avoid the possibility of their capture.
        3. Simply cutting lines and leaving entangled gear on sea turtles is strongly discouraged. If a sea turtle is cut loose with the line attached, the flipper may eventually become occluded, necrotic and infected, and this could lead to mortality.

    iii. NMFS must distribute information on the status and identification of smalltooth sawfish and encourage reporting of smalltooth sawfish sightings and interactions to the National Sawfish Database.

    iv. NMFS must distribute information reminding reef fish fishermen they should take the following actions to safely handle and release an incidentally caught smalltooth sawfish:

1. Leave the sawfish, especially the gills, in the water as much as possible.
2. Do not remove the saw (rostrum) or injure the animal in any way.
3. Remove as much fishing gear as safely possible from the animal.
4. If it can be done safely, untangle any line wrapped around the saw.
5. Use extreme caution when handling and releasing sawfish as the saw can thrash violently from side to side.

v. As part of a strategy to reduce vessel strikes of sea turtles, particularly loggerhead sea turtles, NMFS must distribute information on the growing sea turtle vessel strike problem in the Gulf and any vessel strike avoidance measures to all reef fish fishermen. NMFS must also work with its partners to promote research for a better understanding of the problem and how to minimize it.

2. NMFS must encourage fishermen to maintain daily communications with other local vessel captains regarding protected species interactions, with the goal of identifying and exchanging information relevant to avoiding protected species bycatch.

The following terms and conditions implement RPM No. 2.

3. NMFS must conduct or fund projects to (1) characterize the fishery to better understand the variations and similarities among the fleet in fishing gear and techniques, (2) characterize its interactions with sea turtles and smalltooth sawfish, and (3) explore potential fishing gear and fishing behavior modifications that reduce adverse impacts from this fishery.

4. NMFS must update its careful release protocols and modify release gears as new information becomes available. If necessary, NMFS, in cooperation with the GMFMC, must revise associated regulatory requirements.

The following terms and conditions implement RPM No. 3.

5. NMFS must ensure observer coverage is sufficient to produce a statistically reliable sample of the bottom longline component of the Gulf reef fish fishery. The RFOP must be operated to meet the recommended precision goal established by NMFS (2004): less than 30 percent CV for annual loggerhead sea turtle bycatch estimates for the commercial bottom longline component of the reef fish fishery.

6. The relatively rare nature of captures in the vertical line component of the Gulf reef fish fishery and the large number of permitted vessels are expected to make achieving CVs less than 30 percent for sea turtle bycatch estimates of these listed species likely infeasible. Regardless, NMFS must increase observer coverage in this fishery component from 2006-2008 levels to test the assumption that sea turtle takes are as rare as estimated. To meet this requirement, NMFS will require that the same proportionate level of

coverage found necessary to meet the precision goal in no. 5 be met in the commercial vertical line component of the fishery at least one year of every three years.

7. The extreme rarity of captures in the Gulf reef fish fishery of smalltooth sawfish and some infrequently caught sea turtle species (e.g., hawksbills) make achieving bycatch estimates with CVs less than 30 percent of these listed species infeasible. For smalltooth sawfish, NMFS must determine and implement the number of trips, sets, and/or hook-hours that must be observed in areas typically fished off southwest Florida and adjacent to where smalltooth sawfish are most common, such as off the Florida Keys to be confident that smalltooth sawfish take is as extremely rare as estimated.

8. Observers must record information as specified on the SEFSC sea turtle life history form for any sea turtle captured. For any smalltooth sawfish captured, observers must record the date, time, location (lat./long.), water depth, estimated total length, estimated length of saw, tag ID(s) if present, gear, target species, tackle (hook brand, type, size, etc.), where hooked and/or entangled, and bait type. Photographs must be taken to confirm species identity and release condition. If feasible, observers should tag any sea turtles or smalltooth sawfish caught. Observers must also collect tissue samples from sea turtles for genetic analysis. This opinion serves as the permitting authority for taking such tissue samples (without the need for an additional section 10 permit). NMFS must ensure that any observers employed are equipped with the tools, supplies, training, and instructions to collect and store tissue samples. Samples collected must be analyzed to determine the genetic identity of individual sea turtles caught in the fishery.

9. NMFS must require its observers to report the number of hooks fished and the number of hooks onboard to comply with the limit of 750 hooks fished and an additional 250 hooks onboard. Periodic reviews of observer data should be conducted by NMFS for the purposes of testing assumptions made in this opinion.

10. NMFS must require SEFSC observers to notify SEFSC observer program staff when takes occur, and observer program staff to report all observed takes via email to the SERO no later than three days after conclusion of each trip, and sooner if possible. Although total fishing effort will not be available for extrapolation, this data may be assessed for other purposes.

11. A periodic review of VMS data from bottom longline vessels must be conducted to ensure compliance with the proposed time/area closures.

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

13. NMFS must develop a specialized survey for estimating recreational sea turtle takes. The survey must be developed by July 2010 and implemented no later than July 2011.

14. NMFS must work with its partners to ensure that STSSN participants collect any fishing gear found associated with sea turtle strandings and submit it, along with a completed Fishing gear Submission Form and a copy of the corresponding STSSN Stranding Report to the SEFSC, for fishery type identification. A database containing this information must be maintained and incorporated into the STSSN database on a quarterly basis, and a summary of the results shared with F/SER3.

15. NMFS must continue to coordinate with the STSSN and states to monitor strandings. If stranding trends show a significant increase in hook-and-line gear related strandings and these strandings are identified as having gear representative of the reef fish fishery, this may represent new information that would require reinitiation of section 7 consultation.

16. NMFS must monitor the National Sawfish Database for any capture records that may be attributed to the Gulf reef fish fishery.

17. SEFSC must prepare an annual bycatch report, including bycatch estimates and CPUEs, along with a summary of the methods and data used. The distribution of observed and total fishing effort for the bottom longline component of the Gulf reef fish fishery must also be included.

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.

Sea Turtles:

1. NMFS should support in-water abundance estimates of sea turtles to achieve more accurate status assessments for these species and to better assess the impacts of incidental take in fisheries.

2. NMFS should assess the feasibility of alternative regulatory, permitting, and analytical approaches to reduce bycatch in western North Atlantic fisheries more rapidly and more comprehensively. While the loggerhead recovery plan includes several actions to address the problem of bycatch in various gear types, a more specific plan to address fishery bycatch of loggerhead sea turtles –which we believe to be the main barrier to loggerhead recovery in the Western North Atlantic – is needed to guide NMFS, the states, and the Councils. Development of scientifically-based quantitative bycatch reduction targets and timelines are particularly needed.

Smalltooth Sawfish:

1. NMFS should conduct or fund research or alternative methods (e.g., surveys) on the distribution, abundance, and migratory behavior of adult smalltooth sawfish off Southwest Florida to better understand their occurrence in federal waters and potential for interaction with the Gulf reef fish fishery.

2. NMFS should conduct or fund reproductive behavioral studies to ensure that the incidental capture of smalltooth sawfish in the Gulf reef fish fishery is not disrupting any such activities.

3. NMFS should conduct or fund surveys or other alternative methods for determining smalltooth sawfish abundance in federal Gulf reef fish fishing areas off southwest Florida, adjacent to areas where smalltooth sawfish are known to occur in the greatest concentration (e.g., off the Florida Keys).

11.0 Reinitiation of Consultation

This concludes formal consultation on the Gulf reef fish fishery. As provided in 50 CFR 402.16, reinitiation of formal consultation is required if 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 the 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 (when designated) 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; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, F/SER2 must immediately request reinitiation of formal consultation.

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Appendix 1 Management History of the Gulf of Mexico Reef Fish Fishery (http://gulfcouncil.org/)

I Fishery Management Plans and Amendments:

Original Fishery Management Plan (1984)

The Reef Fish Fishery Management Plan was implemented in November 1984. The regulations, designed to rebuild declining reef fish stocks, included: (1) prohibitions on the use of fish traps, roller trawls, and powerhead-equipped spear guns within an inshore stressed area; (2) a minimum size limit of 13 inches total length (TL) for red snapper with the exceptions that for-hire boats were exempted until 1987 and each angler could keep 5 undersize fish; and, (3) data reporting requirements.

Reef Fish Amendment 1 (1990) and RIR

- Amendment 1, including environmental assessment (EA), regulatory impact review (RIR), and regulatory flexibility analyses (RFA), to the Reef Fish Fishery Management Plan, implemented in 1990, was a major revision of the original FMP. It set as a primary objective of the FMP the stabilization of long-term population levels of all reef fish species by establishing a survival rate of biomass into the stock of spawning age to achieve at least 20 percent spawning stock biomass per recruit (SSBR), relative to the SSBR that would occur with no fishing. The target date for achieving the 20 percent SSBR goal was set at January 1, 2000. Among the management measures implemented were:
- Set a red snapper 13-inch total length minimum size limit, 7-fish recreational bag limit and 3.1 million-pound commercial quota that together were to reduce fishing mortality by 20 percent and begin a rebuilding program for that stock;
- Prohibit the sale of undersized red snapper and delete the allowance to keep 5 undersized red snapper;
- Set a 20-inch total length minimum size limit on red Nassau, yellowfin, black, and gag groupers;
- Set a 50-inch total length minimum size limit on goliath grouper (jewfish);
- Set a 5-grouper recreational bag limit;
- Allow a 2-day possession limit for charter vessels and head boats on trips that extend beyond 24 hours, provided the vessel has two licensed operators aboard as required by the U.S. Coast Guard, and each passenger can provide a receipt to verify the length of the trip;
- All other fishermen fishing under a bag limit are limited to a single day possession limit;
- Set an 11.0 million-pound commercial quota for groupers, with the commercial quota divided into a 9.2 million pound shallow-water grouper quota and a 1.8 million-pound deepwater grouper quota. Shallow-water grouper were defined as black grouper, gag, red grouper, Nassau grouper, yellowfin grouper, yellowmouth grouper, rock hind, red hind, speckled hind, and scamp (until the shallow-water grouper quota is filled). Deep-water

grouper were defined as misty grouper, snowy grouper, yellowedge grouper, warsaw grouper, and scamp once the shallow-water grouper quota is filled. Goliath grouper (jewfish) are not included in the quotas;

- Set a 12-inch total length minimum size limit on gray, mutton, and yellowtail snappers;
- Set an 8-inch total length minimum size limit on lane and vermilion snappers;
- Set a 10-snapper recreational bag limit on snappers in aggregate, excluding red, lane, and vermilion snapper;
- Set an 8-inch total length minimum size limit for black sea bass;
- Set a 28-inch fork length minimum size limit and 3 fish per person per day bag limit for recreational harvest of greater amberjack, and a 36-inch fork length minimum size limit of greater amberjack for commercial harvest;
- Establish a framework procedure for specification of TAC to allow for annual management changes;
- Establish a longline and buoy gear boundary at approximately the 50 fathom depth contour west of Cape San Blas, Florida and the 20 fathom depth contour east of Cape San Blas, inshore of which the directed harvest of reef fish with longlines and buoy gear was prohibited and the retention of reef fish captured incidentally in other longline operations (e.g., sharks) was limited to the recreational bag limit. Subsequent changes to the longline/buoy boundary could be made through the framework procedure for specification of TAC;
- Limit trawl vessels (other than vessels operating in the unsorted groundfish fishery) to the recreational size and bag limits of reef fish;
- Establish fish trap permits, allowing up to a maximum of 100 fish traps per permit holder;
- Prohibit the use of entangling nets for directed harvest of reef fish. Retention of reef fish caught in entangling nets for other fisheries is limited to the recreational bag limit;
- Establish the fishing year to be January 1 through December 31;
- Extend the stressed area to the entire Gulf coast;
- Establish a commercial reef fish vessel permit.

Reef Fish Amendment 2 (1990)

Amendment 2, including EA, RIR and RFA, implemented in 1990, prohibited the harvest of goliath grouper (jewfish) to provide complete protection for this species in federal waters in response to indications that the population abundance throughout its range was greatly depressed. This amendment was initially implemented by emergency rule.

Reef Fish Amendment 3 (1991)

Amendment 3, including EA and RIR, implemented in July 1991, provided additional flexibility in the annual framework procedure for specifying TAC by allowing the target date for rebuilding an overfished stock to be changed depending on changes in scientific advice, except that the rebuilding period cannot exceed 1.5 times the generation time of the species under consideration. It revised the FMP's primary objective, definitions of optimum yield and overfishing and framework procedure for TAC by replacing the 20 percent SSBR target with 20 percent spawning potential ratio (SPR). The amendment also transferred speckled hind from the shallow-water grouper quota category to the deepwater grouper quota category.

Reef Fish Amendment 4 (1992)

Amendment 4, including EA, RIR and initial RFA (IRFA), implemented in May 1992, established a moratorium on the issuance of new reef fish permits for a maximum period of three years. The moratorium was created to moderate short term future increases in fishing effort and to attempt to stabilize fishing mortality while the Council considers a more comprehensive effort limitation program. It allows the transfer of permits between vessels owned by the permittee or between individuals when the permitted vessel is transferred. Amendment 4 also changed the time of the year that TAC is specified from April to August and included additional species in the reef fish management unit.

Reef Fish Amendment 5 (1994)

Amendment 5, including a supplemental EIS (SEIS), RIR and IRFA, implemented in February 1994, established restrictions on the use of fish traps in the Gulf of Mexico EEZ, implemented a three-year moratorium on the use of fish traps by creating a fish trap endorsement and issuing the endorsement only to fishermen who had submitted logbook records of reef fish landings from fish traps between January 1, 1991 and November 19, 1992, created a special management zone (SMZ) with gear restrictions off the Alabama coast, created a framework procedure for establishing future SMZ's, required that all finfish except for oceanic migratory species be landed with head and fins attached, and closed the region of Riley's Hump (near Dry Tortugas, Florida) to all fishing during May and June to protect mutton snapper spawning aggregations.

Reef Fish Amendment 6 (1993)

Amendment 6, including EA, RIR and RFA, implemented in June 1993, extended the provisions of an emergency rule for red snapper endorsements for the remainder of 1993 and 1994, and it allowed the red snapper trip limits for qualifying and non-qualifying permitted vessels to be changed under the framework procedure for specification of TAC.

Reef Fish Amendment 7 (1994)

Amendment 7, including EA, RIR, and IRFA, implemented in February 1994, established reef fish dealer permitting and record keeping requirements, allowed transfer of fish trap permits and endorsements between immediate family members during the fish trap permit moratorium, and allowed transfer of other reef fish permits or endorsements in the event of the death or disability of the person who was the qualifier for the permit or endorsement. A proposed provision of this amendment that would have required permitted vessels to sell harvested reef fish only to permitted dealers was disapproved by the Secretary of Commerce and was not implemented.

Reef Fish Amendment 8 (1995)

Amendment 8, including EA, RIR and IRFA, proposed establishment of a red snapper Individual Transferable Quota (ITQ) system. It was approved by NMFS and final rules were published in the Federal Register on November 29, 1995; however, concerns about Congressional funding of the ITQ system made it inadvisable for the ITQ system to become operational, pending Congressional action. In October 1996, Congress, through reauthorization of the Magnuson-Stevens Act, repealed the red snapper ITQ system and prohibited Councils from submitting, or NOAA Fisheries from approving and implementing, any new individual fishing quota program before October 1, 2000.

Reef Fish Amendment 9 (1994)

Amendment 9, including EA, RIR and IRFA, implemented in July 1994, provided for collection of red snapper landings and eligibility data from commercial fishermen for the years 1990 through 1992. The purpose of this data collection was to evaluate the initial impacts of the limited access measures being considered under Amendment 8 and to identify fishermen who may qualify for initial participation under a limited access system. This amendment also extended the reef fish permit moratorium and red snapper endorsement system through December 31, 1995, in order to continue the existing interim management regime until longer term measures can be implemented. The Council received the results of the data collection in November 1994, at which time consideration of Amendment 8 resumed.

Reef Fish Amendment 10 (not submitted)

Withdrawn Amendment 10, including EA, RIR and IRFA, would have extended the validity of additional fish trap endorsements for the duration of the fish trap moratorium that was implemented under Amendment 5. These additional endorsements were to have been issued under an emergency rule, requested in March 1994, to alleviate economic hardships after the Council heard from fishermen who entered the fish trap fishery after the November 19, 1992 cutoff date and stated that they were unaware of the impending moratorium. The Council rejected the proposed amendment in May 1994 after NOAA Fisheries stated that it had notified fishermen of the pending moratorium and fish trap endorsement criteria during the time between Council final action and NOAA Fisheries implementation if they asked about fish trap rules or if they requested application materials and NOAA Fisheries was aware that it was for purposes of entering the fish trap fishery. The Council also considered arguments that the change in qualifying criteria circumvented the intent of the fish trap moratorium to halt expansion of the fish trap fishery at the November 19, 1992 level. After the Council rejected Amendment 10, NOAA Fisheries subsequently rejected the emergency request.

Reef Fish Amendment 11 (1996)

Amendment 11, including EA, RIR and IRFA, was partially approved by NMFS and implemented in January 1996. The six approved provisions are: (1) limit sale of Gulf reef fish by permitted vessels to permitted reef fish dealers; (2) require that permitted reef fish dealers purchase reef fish caught in Gulf federal waters only from permitted vessels; (3) allow transfer of reef fish permits and fish trap endorsements in the event of death or disability; (4) implement a new reef fish permit moratorium for no more than five years or until December 31, 2000, while the Council considers limited access for the reef fish fishery; (5) allow permit transfers to other persons with vessels by vessel owners (not operators) who qualified for their reef fish permit; and (6) allow a one time transfer of existing fish trap endorsements to permitted reef fish vessels whose owners have landed reef fish from fish traps in federal waters, as reported on logbooks received by the Science and Research Director of NOAA Fisheries from November 20, 1992 through February 6, 1994. NOAA Fisheries disapproved a proposal to redefine Optimum Yield from 20 percent SPR (the same level as overfishing) to an SPR corresponding to a fishing mortality rate of F0.1 until an alternative operational definition that optimizes ecological, economic, and social benefits to the Nation could be developed. In April 1997, the Council resubmitted the Optimum Yield definition with a new proposal to redefine Optimum Yield as 30 percent SPR. The resubmission document was disapproved by NMFS.

Reef Fish Amendment 12 (1997)

Amendment 12, including EA, RIR and IRFA, implemented in January 1997, reduced the greater amberjack bag limit from three fish to one fish per person, and created an aggregate bag limit of 20 reef fish for all reef fish species not having a bag limit.

Reef Fish Amendment 13 (1996)

Amendment 13, including EA, RIR and IRFA, implemented in September 1996, further extended the red snapper endorsement system through the remainder of 1996 and, if necessary, through 1997, in order to give the Council time to develop a permanent limited access system that was in compliance with the new provisions of the Magnuson-Stevens Act.

Reef Fish Amendment 14 (1997)

Amendment 14, including EA, RIR and IRFA, implemented in March and April 1997, provided for a ten-year phase-out for the fish trap fishery; allowed transfer of fish trap endorsements for the first two years and thereafter only upon death or disability of the endorsement holder, to another vessel owned by the same entity, or to any of the 56 individuals who were fishing traps after November 19, 1992 and were excluded by the moratorium; and prohibited the use of fish traps west of Cape San Blas, Florida. The amendment also provided the Regional Administrator (RA) of NOAA Fisheries with authority to reopen a fishery prematurely closed before the allocation was reached, and modified the provisions for transfer of commercial reef fish vessel permits. In addition, the amendment prohibited the harvest or possession of Nassau grouper in the Gulf EEZ, consistent with similar prohibitions in Florida state waters, the south Atlantic EEZ, and the Caribbean EEZ.

Reef Fish Amendment 15 (1998)

Amendment 15, including EA, RIR and IRFA, implemented in January 1998, prohibited harvest of reef fish from traps other than permitted reef fish traps, stone crab traps, or spiny lobster traps.

Reef Fish Amendment 16A (1998)

Amendment 16A, including EA, RIR and IRFA, submitted to NMFS in June 1998, was partially approved and implemented on January 10, 2000. The approved measures provided: (1) that the possession of reef fish exhibiting the condition of trap rash on board any vessel with a reef fish permit that is fishing spiny lobster or stone crab traps is prima facie evidence of illegal trap use and is prohibited except for vessels possessing a valid fish trap endorsement; (2) that NOAA Fisheries establish a system design, implementation schedule, and protocol to require implementation of a vessel monitoring system (VMS) for vessels engaged in the fish trap fishery, with the cost of the vessel equipment, installation, and maintenance to be paid or arranged by the owners as appropriate; and (3) that fish trap vessels submit trip initiation and trip termination reports. Prior to implementing this additional reporting requirement, there will be a one-month fish trap inspection/compliance/education period, at a time determined by the NOAA Fisheries Regional Administrator and published in the Federal Register. During this window of opportunity, fish trap fishermen will be required to have an appointment with NMFS enforcement for the purpose of having their trap gear, permits, and vessels available for inspection. The disapproved measure was a proposal to prohibit fish traps south of 25.05 degrees north latitude beginning February 7, 2001. The status quo 10-year phase-out of fish traps in areas in the Gulf EEZ is therefore maintained.

Reef Fish Amendment 16B (1999)

Amendment 16B, including EA, RIR and IRFA, was submitted to NMFS in January 1999, and was implemented by NMFS on November 24, 1999. This amendment set a recreational bag limit of one speckled hind and one warsaw grouper per vessel, with the prohibition on the sale of these species when caught under the bag limit.

Reef Fish Amendment 17 (2000)

Amendment 17, including EA, RIR and IRFA, was submitted to NOAA Fisheries in September 1999, and was implemented by NOAA Fisheries on August 10, 2000. This amendment extended the commercial reef fish permit moratorium for another five years, from its previous expiration date of December 31, 2000 to December 31, 2005, unless replaced sooner by a comprehensive controlled access system. The purpose of the moratorium is to provide a stable environment in the fishery necessary for evaluation and development of a more comprehensive controlled access system for the entire commercial reef fish fishery.

Reef Fish Amendment 18A

Amendment 18A, including SEIS, RIR and IRFA, addresses issues primarily involving grouper management. Issues addressed in this amendment include the following:

- Effort Capacity Control
    - Simultaneous Commercial and Charter Vessel Permits on a Vessel
    - Maximum Crew Size on a Charter Vessel When Fishing Commercially
- Enforcement and Monitoring Issues
    - Use of Reef Fish for Bait
    - Vessel Monitoring System
    - Careful Release Protocols for Sea Turtle Release

Reef Fish Amendment 18B

Amendment 18B, including SEIS, RIR and IRFA, is currently under development. It addresses rebuilding plans for Nassau grouper and goliath grouper, incorporation of the SEDAR process into the framework procedure for setting TAC, and setting of Sustainable Fisheries Act parameters (minimum stock size threshold, maximum fishing mortality rate, and associated parameters) for reef fish species that have not yet had those parameters defined.

Reef Fish Amendment 19 (aka Generic Amendment for Tortugas Ecological Reserves) (2002)

Amendment 19, including a final SEIS, RIR and IRFA, also known as the Generic Amendment Addressing the Establishment of the Tortugas Marine Reserves, was submitted to NMFS in March 2001, and was implemented on August 19, 2002. This amendment, affecting all FMPs for the Gulf fisheries (as Reef Fish Amendment 19, Coastal Pelagics Amendment 13, Coral Amendment 4, Red Drum Amendment 4, Shrimp Amendment 12, Spiny Lobster Amendment 7, and Stone Crab Amendment 8), establishes two marine reserve areas off the Tortugas area and prohibits fishing for any species and anchoring by fishing vessels inside the two marine reserves.

Reef Fish Amendment 20 (aka Generic Charter/Headboat Moratorium Amendment) (2002)

Amendment 20, including EA, RIR and IRFA, also known as the Corrected Charter/Headboat Moratorium Amendment, was initially implemented in July 2002. It is designated both as Reef Fish Amendment 20 and Coastal Pelagic FMP Amendment 14. This amendment established a 3-year moratorium on the issuance of new charter and headboat vessel permits in the recreational for hire fisheries in the Gulf EEZ. The amendment was approved by NOAA Fisheries, and the provisions to determine eligibility and distribute moratorium permits was implemented on July 29, 2002, with the moratorium originally scheduled to become effective on December 26, 2002. On December 17, 2002, however, NMFS published an emergency action that deferred the date when "moratorium" charterboat permits are required from December 26, 2002, until June 16, 2003. This action was required because the final rule implementing the for-hire permit moratorium contained an error regarding eligibility that needed to be resolved before the moratorium could take effect. The purpose of this moratorium is to limit future expansion in the recreational for-hire fishery while the Council monitors the impact of the moratorium and considers the need for a more comprehensive effort management system in the for-hire recreational fishery. The Council set a qualifying cutoff date of March 29, 2001 in order to include all currently permitted vessels and vessels which have applied for a permit as of that date. The qualifying provisions also included persons who had a recreational for-hire vessel under construction prior to March 29, 2001 and who could show expenditures of at least five thousand dollars. In addition, persons who met the eligibility requirements to qualify as a historical captain (USCG licensed and operating as a captain of a for-hire vessel prior to March 29, 2001, will qualify for a permit within 90 days of the final rule, and at least 25 percent of earned income was from recreational for-hire fishing in one of the last four years ending March 29, 2001) were issued a letter of eligibility, which can be replaced by a permit/endorsement valid only on the vessel that is operated by the historical captain.

Reef Fish Amendment 21 (2004)

Amendment 21, including SEIS, RIR and IRFA, implemented in July 2004, continues the Madison-Swanson and Steamboat Lumps marine reserves for an additional 6 years, until July 2010, and modifies the fishing restrictions within the reserves to allow surface trolling on a seasonal basis.

Reef Fish Amendment 22 (submitted to NMFS June 2004)

Amendment 22, including SEIS, RIR and IRFA, was implemented July, 2005. It contains a rebuilding plan and sets the SFA parameters for red snapper. It also establishes bycatch reporting methodologies for the reef fish fishery.

Reef Fish Amendment 23 (submitted to NMFS October 2004)

Amendment 23, including SEIS, RIR and IRFA, was implemented July, 2005. It contains a rebuilding plan and sets the SFA parameters for vermilion snapper.

Reef Fish Amendment 24 (2005)

Amendment 24, including EA, RIR and IRFA, was implemented August, 2005. It establishes a permanent limited access system for the commercial fishery for Gulf reef fish. Permits issued under the limited access system are renewable and transferable. This amendment was developed concurrently with Coastal Pelagics FMP Amendment 15, which creates a permanent limited access system for the mackerel fishery.

Reef Fish Amendment 25 (2006)

Implemented June, 2006, this amendment establishes a limited access system on for-hire reef fish and CMP permits. Permits are renewable and transferable in the same manner as currently prescribed for such permits. The Council will have periodic review at least every 10 years on the effectiveness of the limited access system.

Reef Fish Amendment 26 and FEIS (2007)

Implemented January, 2007, Amendment 26 establishes an individual fishing quota (IFQ) system for the commercial red snapper fishery.

Reef Fish Amendment 27 (2008)

Amendment 27 was implemented in February, 2008, and addresses overfishing and bycatch issues in both the red snapper directed fishery and the shrimp fishery. The amendment sets TAC at 5.0 mp between 2008 and 1020. The commercial sector will receive a quota of 2.55 mp, with the remaining quota of 2.45 mp going to the recreational sector. The amendment also reduces the commercial size limit to 13”, reduces the recreational bag limit to two fish, eliminates a bag limit for captain and crew aboard a for-hire vessel, and sets the recreational fishing season from June 1 – September 30. In addition, all commercial and recreational reef fish fisheries will be required to use non-stainless steel circle hooks when using natural baits, as well as venting tools and dehooking devices.

For the shrimp fishery, the amendment establishes a target reduction goal for juvenile red snapper mortality of 74% less than the benchmark years of 2001-2003, reducing that target goal to 67% beginning in 2011, eventually reducing the target to 60% by 2032. If necessary, a seasonal closure in the shrimp fishery will occur in conjunction with the annual Texas closure (which begins on or about May 15). The need for a closure will be determined by an annual evaluation by the NMFS Regional Administrator.

Reef Fish Amendment 28

Amendment 28 is under consideration for the possible allocation of red grouper.

Reef Fish Amendment 29 (2009)

Amendment 29 was approved by the Council in January, 2009 and is currently under Secretarial Review. The amendment establishes an individual fishing quota (IFQ) system for the commercial grouper and tilefish fishery.

Reef Fish Amendment 30A (2008)

Implemented August, 2008, Amendment 30A addresses the overfishing and overfished status of Gray Triggerfish and Greater Amberjack. The amendment proposes to reduce the harvest of both greater amberjack and gray triggerfish in order to end overfishing and rebuild the stocks. The amendment also proposes to adjust the allocation of gray triggerfish and greater amberjack catches between recreational and commercial fisheries and set management thresholds and targets to comply with the Sustainable Fisheries Act (SFA) for gray triggerfish.

Reef Fish Amendment 30B (2009)

Amendment 30B was submitted to NMFS in August, 2008, and proposes to address the overfishing of Gag grouper, as well as define its maximum stock size threshold (MSST) and optimum yield (OY). The amendment also sets interim allocations of gag and red grouper catches between recreational and commercial fisheries, and makes adjustments to the red grouper total allowable catch (TAC) to reflect the current status of the stock, which is currently at OY levels. Additionally, the amendment establishes annual catch limits (ACLs) and accountability measures (AMs) for the commercial and recreational red grouper fisheries, commercial and recreational gag fisheries, and commercial aggregate shallow-water fishery.

For the commercial sector, the amendment for 2009 reduces the aggregate shallow-water grouper quota from 8.80 mp to 7.8 mp, increases the red grouper quota from 5.31 mp to 5.75 mp, and sets a gag quota of 1.32 mp. The gag and shallow-water grouper quotas are scheduled to increase in subsequent years as the gag stock rebuilds. When 80 percent of a grouper species quota is reached, the allowable catch per trip for that species will be reduced to an incidental catch limit of 200 pounds until the species quota is filled in order to reduce discard mortality of that species while fishermen target other species.

The amendment repeals the commercial closed season of February 15 to March 15 on gag, black and red grouper, and replaces it with a January through April seasonal area closure to all fishing at the Edges 40 fathom contour, a 390 nautical square mile gag spawning region northwest of Steamboat Lumps. In addition, the Steamboat Lumps and Madison-Swanson fishing area restrictions will be continued indefinitely.

For the recreational sector, the amendment reduces the aggregate grouper bag limit from five fish to four, increases the red grouper bag limit from one fish to two, and sets a two-fish bag limit for gag. A recreational closed season on shallow-water grouper was established from February 1 through March 31.

Finally, the amendment requires that all vessels with federal commercial or charter reef fish permits must comply with the more restrictive of state or federal reef fish regulations when fishing in state waters.

II Reef Fish Regulatory Amendments:

- A March 1991 regulatory amendment reduced the red snapper TAC from 5.0 million pounds to 4.0 million pounds to be allocated with a commercial quota of 2.04 million pounds and a 7-fish recreational daily bag limit (1.96 million pound allocation) beginning in 1991. This amendment also contained a proposal by the Council to effect a 50 percent reduction of red snapper bycatch in 1994 by the offshore EEZ shrimp trawler fleet, to occur through the mandatory use of finfish excluder devices on shrimp trawls, reductions in fishing effort, area or season closures of the shrimp fishery, or a combination of these actions.

  This combination of measures was projected to achieve a 20 percent SPR by the year 2007. The 2.04 million pound quota was reached on August 24, 1991, and the red snapper fishery was closed to further commercial harvest in the EEZ for the remainder of the year. In 1992, the commercial red snapper quota remained at 2.04 million pounds; however, extremely heavy harvest rates resulted in the quota eing filled in just 53 days, and the commercial red snapper fishery was closed on February 22, 1992.
- A July 1991 regulatory amendment, including EA and RIR, implemented November 12, 1991, provided a one-time increase in the 1991 quota for shallow-water groupers from 9.2 million pounds to 9.9[2] million pounds. This action was taken to provide the commercial fishery an opportunity to harvest 0.7 million pounds that went unharvested in 1990 due to an early closure of the fishery in 1990. NMFS had projected the 9.2 million-pound quota to be reached on November 7, 1990, but subsequent data showed that the actual harvest was 8.5 million pounds.
- A November 1991 regulatory amendment, including EA RIR and IRFA, implemented June 22, 1992, raised the 1992 commercial quota for shallow-water groupers to 9.8 million pounds (using the corrected gutted-to-whole weight conversion factor of 1.05, see

footnote 1), after a red grouper stock assessment indicated that the red grouper SPR was substantially above the Council's minimum target of 20 percent, and the Council concluded that the increased quota would not materially impinge on the long-term viability of at least the red grouper stock.

- An October 1992 regulatory amendment raised the 1993 red snapper TAC from 4.0 million pounds to 6.0 million pounds to be allocated with a commercial quota of 3.06 million pounds and a recreational allocation of 2.94 millions pounds (to be implemented by a 7-fish recreational daily bag limit). The amendment also changed the target year to achieve a 20 percent red snapper SPR from 2007 to 2009, based on the Plan provision that the rebuilding period may be for a time span not exceeding 1.5 times the potential generation time of the stock and an estimated red snapper generation time of 13 years (Goodyear 1992).
- An October 1993 regulatory amendment, including EA RIR and RFA, implemented January 1, 1994, set the opening date of the 1994 commercial red snapper fishery as February 10, 1994, and restricted commercial vessels to landing no more than one trip limit per day. The shallow-water grouper regulations were also evaluated but no change was made. The shallow-water grouper TAC, which previously had only been specified as a commercial quota, was specified as a total harvest of 15.1 million pounds (with 9.8 million pounds allocated to the commercial quota) and 20-inch TL size limit for gag, red, Nassau, yellowfin and black grouper.
- An October 1994 regulatory amendment retained the 6 million pound red snapper TAC and commercial trip limits and set the opening date of the 1995 commercial red snapper fishery as February 24, 1995; however, because the recreational sector exceeded its 2.94 million pound red snapper allocation each year since 1992, this regulatory amendment reduced the daily bag limit from 7 fish to 5 fish, and increased the minimum size limit for recreational fishing from 14 inches to 15 inches a year ahead of the scheduled automatic increase.
- A regulatory amendment to set the 1996 red snapper TAC, dated December 1995, raised the red snapper TAC from 6 million pounds to 9.12 million pounds, with 4.65 million pounds allocated to the recreational sector. Recreational size and bag limits remained at 5 fish and 15 inches total length. The recovery target date to achieve 20 percent SPR was extended to the year 2019, based on new biological information that red snapper live longer and have a longer generation time than previously believed. A March 1996 addendum to the regulatory amendment split the 1996 and 1997 commercial red snapper quotas into two seasons each, with the first season opening on February 1 with a 3.06 million pound quota, and the second season opening on September 15 with the remainder of the annual quota.
- A March 1997 regulatory amendment changed the opening date of the second 1997 commercial red snapper season from September 15 to September 2 at noon and closed the season on September 15 at non; thereafter, the commercial season was opened from noon of the first day to non of the fifteenth day of each month until the 1997 quota was reached. it also complied with the new Magnuson-Stevens Act requirement that recreational red snapper be managed under a quota system by authorizing the NMFS Regional Administrator to close the recreational fishery in the EEZ at such time as projected to be necessary to prevent the recreational sector from exceeding its allocation.

Subsequent to implementation of a recreational red snapper quota, the recreational red snapper fishery filled its 1997 quota of 4.47 million pounds, and was closed on November 27, 1997 for the remainder of the calendar year.

- A November 1997 regulatory amendment canceled a planned increase in the red snapper minimum size limit to 16 inches that had been implemented through Amendment 5, and retained the 15-inch minimum size limit.
- A January 1998 regulatory amendment proposed maintaining the status quo red snapper TAC of 9.12 million pounds, but set a zero bag limit for the captain and crew of for-hire recreational vessels in order to extend the recreational red snapper quota season. The NMFS provisionally approved the TAC, releasing 6 million pounds, with release of all or part of the remaining 3.12 million pounds to be contingent upon the capability of shrimp trawl bycatch reduction devices (BRDs) to achieve better than a 50 percent reduction in juvenile red snapper shrimp trawl mortality. The zero bag limit for captain and crew of for-hire recreational vessels was not implemented. Following an observer monitoring program of shrimp trawl BRDs conducted during the Summer of 1998, NMFS concluded that BRDs would be able to achieve the reduction in juvenile red snapper mortality needed for the red snapper recovery program to succeed, ad the 3.12 million pounds of TAC held in reserve was released on September 1, 1998.
- A December 1998 regulatory amendment proposed to maintain the status quo red snapper TAC of 9.12 million pounds; reduce the recreational bag limit for red snapper to 4 fish for recreational fishermen and zero fish for captain and crew of for-hire vessels; set the opening date of the recreational red snapper fishing season to March 1; reduce the minimum size limit for red snapper to 14 inches total length for both the commercial and recreational fisheries; and change the opening criteria for the second commercial red snapper fishing season from the first 15 days to the first 10 days of each month beginning September 1, until the suballocation is met or the season closes on December 31.

  This regulatory amendment follows up the same set of proposals requested under an emergency action, of which NMFS approved only the proposal for a 4-fish bag limit. An interim rule implemented by NMFS in January 1999 reduced the recreational bag limit for red snapper from 5 to 4 fish per person and retained the 15-inch minimum size limit for both the commercial and recreational fishing season to commence in January 1999.
- An August 1999 regulatory amendment, including EA RIR and IRFA, implemented June 19, 2000, increased the commercial size limit for gag from 20 to 24 inches TL, increased the recreational size limit for gag from 20 to 22 inches TL, prohibited commercial sale of gag, black, and red grouper each year from February 15 to March 15 (during the peak of gag spawning season), and established two marine reserves on areas suitable for gag and other reef fish spawning aggregations sites that are closed year-round to fishing for all species under the Council's jurisdiction. The two sites cover 219 square nautical miles near the 40-fathom contour, off west central Florida. An additional proposal to continue increasing the recreational minimum size limit for gag and black grouper by one inch per year until it reached 24 inches TL was rejected by NOAA Fisheries because it was felt that it would have a disproportionate impact on the recreational fishery vs. the commercial fishery.
- A February 2000 regulatory amendment, currently under review by NMFS, proposes to maintain the status quo red snapper TAC of 9.12 million pounds for the next two years,

pending an annual review of the assessment; increase the red snapper recreational minimum size limit from 15 inches to 16 inches total length; set the red snapper recreational bag limit at 4 fish; reinstate the red snapper recreational bag limit for captain and crew of recreational for-hire vessels; set the recreational red snapper season to be April 15 through October 31, subject to revision by the Regional Administrator to accommodate reinstating the bag limit for captain and crew, set the commercial red snapper Spring season to open on February 1 and be open from noon on the 1st until noon on the 10th of each month until the Spring sub-quota is reached; set the commercial red snapper Fall season to open on October 1 and be open from noon on the 1st to noon on the 10th of each month until the remaining commercial quota is reached; retain the red snapper commercial minimum size limit at status quo 15 inches total length; and allocate the red snapper commercial season sub-quota at 2/3 of the commercial quota, with the Fall season sub-quota as the remaining commercial quota.

III Reef Fish Secretarial Amendments

Section 304(e)(5) of the MSFCMA states that if, within the one-year period beginning on the date of identification or notification that a fishery is overfished, the Council does not submit to the Secretary a fishery management plan, plan amendment, or proposed regulations required by paragraph to end overfishing in the fishery and to rebuild affected stocks of fish, the Secretary shall prepare a fishery management plan or plan amendment and any accompanying regulations to stop overfishing and rebuild affected stocks of fish within 9 months.

Due to circumstances including delays in receiving information from NMFS needed to prepare rebuilding plans, and delays resulting from the terrorist events of September 11, 2001, the Council did not meet its deadline for submitting rebuilding plans for red grouper and greater amberjack. As a result, although the amendments below were still prepared predominately by the Council and generally reflect the Council's policy, they were submitted as Secretarial amendments rather than as Council plan amendments. In such cases, the rebuilding plan is, officially, is prepared by the Secretary of Commerce and may be modified by NMFS following submission by the Council).

Secretarial Amendment 1 (2004)

Secretarial Amendment 1, including an SEIS, RIR and IRFA, was initially submitted to NOAA Fisheries in September 2002 and was implemented July 15, 2004. It contains a ten-year rebuilding plan for red grouper based on three-year intervals. It specifies maximum sustainable yield (MSY), optimum yield (OY), maximum fishing mortality threshold (MFMT), and minimum stock size threshold (MSST) levels that comply with the Sustainable Fisheries Act. A red grouper assessment, completed in 2002, found that approximately a 10% reduction relative to the recent fishing mortality during 1999-2001 was required for the first three years of the rebuilding plan in order to implement the plan. To accomplish this, the Council proposed that the revised Secretarial Amendment include a 5,200 pound shallow-water grouper gutted weight commercial trip limit that will achieve a 10% red grouper harvest reduction, a reduction in the shallow-water grouper quota from 9.35 million pounds gutted weight (9.8 million pounds whole weight) to 8.80 million pounds gutted weight, repeal the Feb. 15 - Mar. 15 closed season on commercial harvest of red grouper, black grouper and gag in the Gulf EEZ (which appeared to be resulting in mini-derby fisheries around the closed season rather than a fishing reduction), and set a recreational bag limit of two red grouper out of the five aggregate grouper bag limit per person, with a double bag limit allowed for persons on qualified for-hire boats that are out over 24 hours. In addition, the Council proposed changing the quota for deep-water grouper from 1.6 million pounds whole weight (equal to 1.35 million pounds landed weight) to a gutted weight quota of 1.02 million pounds (equal to the average annual harvest 1996-2000), and establishing a landed weight quota for tilefish (all tilefish species in aggregate) at 0.44 million pounds (average annual harvest 1996-2000). NMFS rejected the proposed 5,200 pound shallow-water grouper trip limit and the repeal of the February 15 - March 15 commercial closed season. The remaining proposed measures were approved, and NOAA Fisheries added a commercial red grouper quota of 5.31 million pounds gutted weight with the stipulation that the commercial shallow-water grouper fishery close when either the shallow-water grouper quota or red grouper quota is reached, whichever occurs first.

Secretarial Amendment 2 (2003)

Secretarial Amendment 2, including EA, RIR and RFA, was approved by NMFS on June 17, 2003. It sets MSY, OY, MFMT, and MSST levels for greater amberjack that are in compliance with the Sustainable Fisheries Act, and it establishes a ten-year rebuilding plan for greater amberjack based on three-year intervals. No specific management measures were proposed in this amendment, since the greater amberjack harvest is currently within the TAC specified for the first three-year interval.

Appendix 2: Summary of Sea Turtle Incidental Take Levels Authorized Under Incidental Take Statements Associated with NMFS' Opinions For Current Federal Fisheries Occurring[13] in the Gulf of Mexico EEZ.

Fishery	Opinion Date	Take Period	Sea Turtle Takes (Mortalities) By Species				
			Loggerhead	Leatherback	Kemp's Ridley	Green	Hawks bill
Southeastern U.S. Shrimp[1]	2002	Annual	163,160 (3,948)[2]	3,090 (80)[2]	155,503 (4,208)[2]	18,757 (514)[2]	640 (640)[2]
Atlantic Pelagic Longline[3]	2004	3-Year	1,905 (339)	1,764 (252)	105 combined (18)		
Atlantic HMS Shark Fisheries[3]	2008	3-Year	679 (346)	74 (47)	2 (1)	2 (1)	2 (1)
Gulf Reef Fish	2005	3-Year	203 (78)	20 (9)	3 (1)	51 (21)	44 (13)
Coastal Migratory Pelagic[4]	2007	Annual	33 (33)	2(2)	4(4)	14(14)	2(2)
South Atlantic/Gulf Spiny Lobster[5]	2009	3-Year	3 (3)	1 (1)	1 (1)	3 (3)	1 (1l)

[1] The Southeastern U.S. shrimp fishery analyzed for its effects on sea turtles occurs in state and federal (i.e. EEZ) waters in both the Atlantic and Gulf of Mexico.
[2]The incidental take authorized in this opinion is based on 1997-2001 effort; current effort in the Gulf is at least 50 percent less; see Table 4.1 in opinion for more recent estimates.
[3]The Atlantic pelagic longline fishery and Atlantic shark fisheries action areas both include the Atlantic, Gulf, and Caribbean EEZ.
[4]The coastal migratory pelagic fishery action area include Atlantic and Gulf EEZ water.
[5]The federal spiny lobster fishery, managed jointly by the GMFMC and SAFMC under the SLFMP, occurs throughout the South Atlantic and Gulf of Mexico regions.

[13] The actions included in the table occur at least in part, but not all entirely within the Gulf. Please see footnotes within the table for more some general information and the associated opinions for more specific details regarding where and how the actions are conducted in the Gulf.

Appendix 3 Summary of Additional Reef Fish Bottom Longline Data Sources Reviewed To Assess the Impact of Reef Fish Bottom Longlines on Sea Turtles

During this consultation, in addition to reviewing the recent observer data that was ultimately used to generate out take estimates, we reviewed and considered all other known datasets containing reef fish bottom longline sea turtle bycatch data. We revisited the datasets reviewed in NMFS (2005a) and incorporated new data as available; we also searched for other new or potentially overlooked data sources. The data sources considered included: Gulf and South Atlantic Fisheries Foundation/University of Florida Commercial Shark Fishery Observer Program (1994-2005), SEFSC Historic Reef-Fish Observer Program (1994-95), SEFSC Bottom Longline Surveys from the Eastern U.S. Gulf of Mexico (2000-2008), Supplementary Discard Data Program (2001-Present), Mote Marine Laboratory Longline Sampling Observer Data (November 2000-October 2005). Summary information is provided below.

Gulf and South Atlantic Fisheries Foundation/University of Florida Commercial Shark Fishery Observer Program (1994-2005)
Although it is possible this dataset contains some sets targeting grouper, theses sets are not identifiable because set target species was not recorded during this time period. The Atlantic HMS shark bottom longline fishery is managed y under a different FMP and biological opinion than Gulf reef fish fisher (NMFS 2008). Although the distribution of reef fish and shark bottom longline sets overlap in some areas of the Gulf, the fisheries operate quite differently. For example, shark bottom longlines are allowed inside of 20 fathoms east of Cape San Blas and 50 fathoms west of Cape San Blas, whereas reef fish bottom longlines are prohibited in these areas. Shark bottom longlines are set overnight, with average soak time (time the last hook enters the water to the time the first hook is hauled back) of 11.5 hours per set. In contrast, reef fish bottom longlines are fished during the day and have an average soak time of only three hours (NMFS 2005a; Hale et al. 2007). Reef fish sets also generally have shorter gangions and use smaller hooks. With these differences, we do not feel it is appropriate to apply the sea turtle catch per unit of effort in the shark bottom longline fishery to the Gulf reef fish fishery.

SEFSC Historic Reef-Fish Observer Program (1994-95)
SEFSC, in cooperation with the GMFMC and the fishing industry, deployed observers on reef-fish vessels in the mid-1990s. A total of 13 longline trips (including 317 sets and some 230,000 hook-sets over 112 sea-days) were observed. Sea turtles were seen in the water, but none were captured.

SEFSC Bottom Longline Surveys from the Eastern U.S. Gulf of Mexico (2000-2008)
The Southeast Fisheries Science Center (SEFSC) Mississippi Laboratories has conducted standardized bottom longline surveys in the Gulf of Mexico, Caribbean, and Western North Atlantic since 1995. Although the primary objective of these surveys was initially assessment of the distribution and abundance of large and small coastal sharks across their known or suspected ranges, in 2001, the surveys were combined into a single annual survey of the U.S. Gulf of Mexico, with the objective to provide fisheries independent data for stock assessment purposes for as many species as possible, including large coastal sharks, snappers, and groupers. An overview of how the surveys have evolved over the years may be reviewed in Ingram et al. 2005 (LCS05/06-DW-27.

Ingram and Henwood (2009) used the time series of data between 2000 and 2008 to develop CPUEs for loggerhead sea turtles in the Eastern Gulf (i.e. east of the mouth of the Mississippi River located at approximately 89.15° west longitude). This time series was used because these survey data were collected using 15/0 circle hooks (Mustad, model # 39960D); the hooks were baited with Atlantic mackerel and fished on one nautical mile of monofilament for one hour. Six loggerhead sea turtles were caught during this time series. Of these, only one loggerhead turtle was collected west of 89.15° west longitude, and that was during the 2006 survey. None of the turtles drowned during one hour soak times; all were release alive. A nominal mean CPUE (CPUE ± standard deviation) of loggerhead sea turtles collected in the Eastern Gulf was calculated on an annual and an overall basis using two approaches. The first approach included all stations conducted in the Eastern Gulf. Using this approach, the annual mean CPUE of loggerhead sea turtles ranged from 0 to 0.018 per 100 hook-hours (i.e. 1.8 per 10,000 hook-hours). The overall mean CPUE was estimated to be 0.006 per 100 hook-hours. The second approach only included stations conducted in the depth range in which red grouper were observed (i.e. 13 – 116 m) in the Eastern Gulf. Using this approach, the annual mean CPUE of loggerhead sea turtles ranged from 0 to 0.027per 100 hook-hours (i.e. 2.7 per 10,000 hook-hours), but the overall mean CPUE was still similarly estimated to be 0.006 per 100 hook-hours

Supplementary Discard Data Program (2001-Present)
As discussed in Section 2.1.2, all Gulf commercial reef fish fishers are required to report their catch and effort data via the CFLP and approximately 20% of Gulf commercial reef fish fishers each year are also required to submit discard data via the recent SDDP. The 2005 biological opinion analyzed available data through July 2004. Since then, only two hardshell sea turtles takes have been reported in bottom longlines. Table 1 includes all of these data.

Table 1. Reported Bottom Longline Sea Turtle Bycatch

Year	Month	Trip Area (Statistical Zone)	Species Caught	Number Caught	Average Weight	Discard Condition
2002	February	6	Unidentified	1	NR	Alive
2002	May	6	Green	1	NR	Alive
2002	June	6	Unidentified	1	NR	Alive
2002	November	4	Loggerhead	1	75	Alive
2002	December	4	Unidentified	1	100	Alive
2004	March	4	Loggerhead	1	30	Alive
2004	April	9	Unidentified	2	50	Alive
2004	May	4	Loggerhead	1	100	Dead
2004	August	5	Loggerhead	1	100	Alive
2005	August	7	Unidentified	1	100	Alive

Both of the new sea turtle takes reported occurred in the eastern Gulf, where all bottom longline records have been located thus far. The two new takes both occurred in August, albeit different years; this is a month we previously did not have records for. The new takes were both reported to be alive when released, like all but one record to date. Both sea turtles were also estimated to be 100 lbs, but as noted in NMFS (2005a), given anecdotal information indicating most fishers describe the sea turtles caught as being large and report just cutting the line, we have no confidence in the reported average weight estimates and believe they may be are highly inaccurate. In hindsight, although we still believe it best not to rely on untrained species identification, based on what we've learned via takes documented in our observer program, loggerhead sea turtles are the most likely species to have been caught. Aside from these points, the two additional records provide no additional insight.

Mote Marine Laboratory Longline Sampling Observer Data (November 2003-October 2005)
Starting in 2004, Mote Marine Laboratory began placing observers aboard reef-fish longline vessels as part of a MARFIN project, titled "Cooperative longline sampling of the west Florida shelf shallow-water grouper complex: characterization of life history, undersized bycatch and targeted habitat." Biological samples were collected during 18 observed normal (4-13 day) longline reef fish fishing trips aboard 7 different longline vessels out of Madeira Beach, Florida, between November 2003 and October 2005 (Burns and Robbins 2006). Of the first ten observed trips, only one (a deepwater grouper trip in May 2004) had any turtle interactions (N. Parnell, pers. comm. 2004). On May 20, 2004, an unidentified sea turtle was caught during a deepwater grouper 10-mile set (1200-1500 hooks) around 27.05°N latitude, 84.09°W longitude at 17:30 hours in 52 fm (325 ft) of water. The total set and haul time was five hours. A second sea turtle take occurred on May 21, 2004, at 27.03°N latitude, 84.07°W longitude at 17:35 hours in 54 fm (315 ft) of water. Total duration of this 10-mile set with a comparable number of hooks was three hours. Although the program continued through early October 2005, sea turtle bycatch data were only available for the first 10 trips (K. Leber, Mote Marine Laboratory, pers. comm.).

Anecdotal Information (2004 to Present)
NMFS (2005a) anecdotal information indicated commercial GOM reef fish fishers typically reported seeing sea turtles in the water when fishing with vertical line and bottom longline gear, but only rarely caught them. There was one report of a vessel catching 35 to 40 sea turtles during a single 2004 trip, but it was not believed to be indicative of the normal catch and our attempts to verify the accuracy and source of the incident were unsuccessful. Experiences with sea turtle captures shared with us since then via recent public testimony and informal conversations vary widely. Some fishermen state they have never caught a sea turtle; some indicate they have caught only a few over their fishing career; others indicate one or two annually is common, but acknowledge there are a few fishermen who have more frequent interactions. For example, one fishermen reported himself not catching more than one, someone he knew who caught 30 one year. Although these anecdotes can provide useful information, because individual experiences and opinion are so diverse and are not comparable relative to effort, we do not at this time consider them a reliable source of information on which to estimate sea turtle impacts associated with this reef fish fishery.

MARFIN Grant (Award Number NA05NMF4331069) (*January through June 2006*)
In 2006, an industry based observer program for the reef fish fishery (bottom longline and bandit gear) was conducted via a MARFIN project. The project was originally set to begin in June of 2005, but with early projected closure of the grouper fishery, the start date was postponed until January 1, 2006 and ran only through June of 2006. During this project, 13 longline trips and 1 vertical line trip was observed, representing 111 days at sea and 156 sets. Gear used was consistently 13/0 circle hooks fished on monofilament leaders. Gear length averaged 9 miles of

galvanized cable with 200 hooks per mile. Leaders measured an average of 8 ft. Vessels averaged 2.3 sets a day. Three turtles were observed taken on reef fish longline gear, all three were loggerheads. Two measured 3 ft in carapace and 1 measured 4 ft in carapace. All three takes occurred in January; two of the loggerheads (3ft carapace) were taken on the same trip. Two were hooked in the mouth and one in the flipper. All three were released with no gear attached; one was documented as injured (Madeira Marine Service 2006)