Endangered Species Act - Section 7 Consultation
Biological Opinion

Agency: National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Southeast Regional Office (SERO)

Activity: Reinitiation of Endangered Species Act (ESA) Section 7 Consultation on the Continued Implementation of the Sea Turtle Conservation Regulations, as Proposed to Be Amended, and the Continued Authorization of the Southeast U.S. Shrimp Fisheries in Federal Waters under the Magnuson-Stevens Act.

Consulting Agency: NOAA, NMFS, SERO, Protected Resources Division (F/SER3) and Sustainable Fisheries Division (F/SER2)

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Approved By:

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Table of Contents

Introduction

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 et seq.), requires each federal agency to ensure any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of any critical habitat of such species. NMFS and the U.S. Fish and Wildlife Service (USFWS) share responsibilities for administering the ESA. When an action of a federal agency may affect an ESA-listed species or its critical habitat, that agency is required to consult with either NMFS or the USFWS, depending upon the protected species 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 concurs with an action agency that its action is not likely to adversely affect a listed species or critical habitat, or issues a biological opinion (opinion) identifying whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely its modify critical habitat. If jeopardy or destruction or adverse modification is found to be likely, NMFS must identify reasonable and prudent alternatives (RPAs) to the action, if any, that would avoid violating section 7(a)(2) of the ESA. The opinion also includes an incidental take statement (ITS) specifying the amount or extent of incidental take of the listed species that may occur. Non-discretionary reasonable and prudent measures (RPMs) to minimize the impact of the incidental taking are included, and conservation recommendations are made. No incidental destruction or adverse modification of critical habitat can be authorized. Therefore, there are no reasonable and prudent measures, only reasonable and prudent alternatives that must avoid destruction or adverse modification.

This document represents NMFS' opinion on the effects of the continued implementation of the sea turtle conservation regulations applicable to shrimp trawling and the continued authorization of Southeast U.S. shrimp fisheries in federal waters on threatened and endangered species and designated critical habitat, in accordance with section 7 of the ESA. This opinion is the result of an intra-agency consultation. For the actions described in this document, NMFS is the action agency under its authorities to conserve sea turtles under the ESA and to manage federal shrimp fishing under the Magnuson-Stevenson Fishery Conservation and Management Act (MSA) (16 U.S.C. §1801 *et seq*.). For the purposes of this consultation, the consulting agency is the NMFS, Southeast Regional Office, Protected Resources Division (F/SER3). There is no applicant associated with this proposed action.

This opinion has been prepared in accordance with section 7 of the ESA and regulations promulgated to implement that section of the ESA. It is based on information provided in recovery plans, research, population modeling efforts, and other relevant published and unpublished scientific and commercial data cited in the Literature Cited section of this document.

1.0 Consultation History

Previous Consultations

NMFS has conducted section 7 consultation on its sea turtle conservation regulations governing the use of Turtle Excluder Devices (TEDs) and its continued authorization of Southeast U.S. shrimp fisheries in federal waters numerous times over the years [i.e., (NMFS 1987; NMFS 1992; NMFS 1994; NMFS 1996a; NMFS 1996b; NMFS 1998; NMFS 2002; NMFS 2005; NMFS 2006)]. A brief summary of each past consultation is provided below.

On September 30, 1987, NMFS completed a section 7 consultation and issued an opinion on the implementation of the 1987 TED regulations (NMFS 1987). The 1987 opinion concluded that the regulations would substantially reduce sea turtle mortalities. At that time, NMFS' policy on ESA section 7 consultations was to address the potential impacts to listed species of discrete management actions and not to address potential adverse effects of the fishery as a whole. The policy was ultimately changed on October 18, 1990, when the Assistant Administrator for Fisheries advised all NMFS Regional Directors that future ESA consultations on fishery management actions must address both the fishery and the proposed management action.

In April 1992, the South Atlantic Fishery Management Council (SAFMC) requested consultation on the South Atlantic Shrimp FMP and the Gulf of Mexico Fishery Management Council (GMFMC) requested consultation on Amendment 6 to the Gulf of Mexico Shrimp FMP. On August 19, 1992, NMFS completed the section 7 consultation and issued an opinion that considered: (1) the shrimp fishery in the Gulf and South Atlantic, (2) its management under the two FMPs, and (3) the proposed implementation of revised sea turtle conservation regulations applicable to trawlers (NMFS 1992). Under the 1992 revised sea turtle conservation regulations, the incidental taking of sea turtles by shrimp trawlers in the Atlantic Ocean off the coast of the southeastern United States and in the Gulf of Mexico was exempted from the ESA's take prohibition if the trawlers complied with specified sea turtle regulations. Generally, these regulations included requiring shrimp trawlers to use TEDs in inshore and offshore waters or, in a few circumstances, to limit the duration of tow-times as an alternative to using TEDs (hence collectively referred to as the sea turtle conservation regulations). The opinion concluded that shrimp trawling, as managed by the GMFMC and SAFMC and in compliance with the proposed sea turtle conservation regulations, was not likely to jeopardize the continued existence of listed species under NMFS jurisdiction. With respect to leatherback sea turtles, however, the opinion stated, "Leatherback mortalities remain a problem that must be addressed to avoid jeopardizing the recovery of this species."

On November 14, 1994, NMFS completed a section 7 consultation and issued an opinion on the impacts of shrimp trawling in the southeastern United States (NMFS 1994). NMFS had reinitiated consultation on shrimp trawling because of extraordinarily high strandings of sea turtles, particularly endangered Kemp's ridley turtles, in Texas and Louisiana. These elevated strandings corresponded to periods of heavy nearshore shrimping effort. The opinion concluded that "[c]ontinued long-term operation of the shrimp fishery in the southeastern U.S., resulting in mortalities of Kemp's ridley turtles at levels observed in the Gulf of Mexico in 1994, was likely to jeopardize the continued existence of the Kemp's ridley population." The jeopardy opinion included an RPA that would allow the shrimp fishery to continue and avoid the likelihood of jeopardizing Kemp's ridley sea turtles. NMFS ultimately implemented all the elements of the RPA, with the exception of a shrimper permitting/registration system.

On June 11, 1996, NMFS completed a section 7 consultation and issued an opinion on the effects of shrimp trawling in the southeastern United States (NMFS 1996a). Consultation had been reinitiated to evaluate the effects of: (1) an April 24, 1996, proposed rule to revise the TED regulations, (2) a plan to implement a shrimp vessel registration system, and (3) strandings exceeding the strandings-based incidental take levels. The opinion concluded that continued operation of the shrimp fishery as proposed was not likely to jeopardize listed sea turtles. The opinion required the shrimp vessel registration system to be proposed formally by the end of 1996. The opinion also eliminated the strandings-based incidental take levels that had been in place since March 1995. The opinion required a more flexible requirement for NMFS to consult with state stranding coordinators to identify significant local stranding events and to implement 30-day restrictions on shrimp trawling in response, as appropriate.

On November 13, 1996, NMFS completed a section 7 consultation and issued an opinion on the impacts of shrimp trawling in the southeastern United States (NMFS 1996b). NMFS had reinitiated consultation on shrimp trawling to evaluate (1) the effects of the final rule implementing the April 24, 1996, proposed rule and (2) elevated loggerhead strandings that occurred during 1996. The opinion concluded that continued operation of the shrimp fishery was not likely to jeopardize listed sea turtles. The final rule implemented the RPA component of the 1994 opinion, requiring NMFS to address mortalities resulting from (1) incorrect installation of TEDs and (2) the certification of TEDs that do not effectively exclude sea turtles. The opinion extended the deadline for finalizing the shrimp vessel registration requirement through February 1997.

On March 24, 1998, NMFS completed a section 7 consultation and issued an opinion on the impacts of shrimp trawling in the southeastern United States (NMFS 1998). NMFS had reinitiated consultation to evaluate the effects of approving the use of a new soft TED, to discuss the decision not to implement a mandatory shrimp vessel registration system (part of the 1994 opinion's RPA), and to evaluate recent data on sea turtle populations and strandings. The opinion concluded that continued operation of the shrimp fishery was not likely to jeopardize listed sea turtles, with continued improved enforcement of the sea turtle conservation regulations and expanded education and outreach programs.

On December 2, 2002, NMFS completed a section 7 consultation and issued an opinion on shrimp trawling in the southeastern United States (NMFS 2002). NMFS had reinitiated consultation to evaluate its proposed implementation of a final rule to further enhance the effectiveness of the sea turtle conservation regulations by: (1) requiring increases in the sizes of TED escape openings to allow large loggerhead and leatherback sea turtles to escape from trawls, (2) correcting the structural weakness of certain TED designs, and (3) modifying the current TED exemptions for bait shrimping and try nets to better protect sea turtles. Based on a report (Epperly et al. 1999; Epperly and Teas 2002) on the sizes of stranded sea turtles compared to the regulatory-minimum TED opening sizes, NMFS was concerned about the adequacy of the current TED requirements in releasing large loggerhead and green sea turtles. In addition, the sizes of the TED escape openings had never been intended to be large enough to exclude leatherback sea turtles. NMFS had instead depended on a leatherback contingency plan for leatherback conservation. However, after implementing the leatherback contingency plan many times in the late 1990s and early 2000s, and also having to implement three emergency rules where the contingency plan did not apply, NMFS determined that the leatherback contingency plan was too complicated and ineffective. NMFS had also reinitiated consultation because new evidence became available and additional analyses had been conducted, allowing NMFS to update its estimates of sea turtle-shrimp trawl interactions and associated effects analyses [see *Effects of the Action* section of 2002 opinion (NMFS 2002) for details]. The opinion concluded that shrimp trawling in the southeastern United States under the proposed revisions to the sea turtle conservation regulations and as managed by the South Atlantic Shrimp FMP, including Amendments 1-5, and the Gulf of Mexico Shrimp FMP, including Amendments 1-11, was not likely to jeopardize the continued existence of listed sea turtles. The determination was based, in part, on the opinion's analysis that showed the revised TED regulations were expected to reduce shrimp trawl related mortality by 94 percent for loggerheads and 97 percent for leatherbacks. Effects on other listed species and designated critical habitat at that time (i.e., listed marine mammals [whales], sturgeons, and Johnson's seagrass) were also analyzed in the 2002 opinion. NMFS concluded listed whales and sturgeons and their critical habitats were not likely to be adversely affected by the proposed action on the basis of discountable effects. Johnson seagrass and its critical habitat were determined to be not affected by the proposed action because they do not occur in federal waters.

On February 25, 2005, NMFS completed a section 7 consultation and issued an opinion on shrimp trawling as managed under the South Atlantic Shrimp FMP (including all amendments through Amendment 6) and its effects on smalltooth sawfish (NMFS 2005). On January 13, 2006, NMFS completed section 7 consultation and issued an opinion on shrimp trawling as managed under the Gulf of Mexico Shrimp FMP (including all amendments through Amendment 13) and its effects on smalltooth sawfish (NMFS 2006). Both of these consultations were conducted solely to address smalltooth sawfish, which on April 1, 2003, was listed as endangered. Based on the species' presence in the Gulf and South Atlantic Exclusive Economic Zone and its documented capture in otter trawls, NMFS had determined smalltooth sawfish may be adversely affected by shrimp trawling, thus formal consultation was required. However, each of the shrimp-sawfish opinions concluded the continued authorization of the subject federal fishery was not likely to jeopardize the continued existence of smalltooth sawfish. Because reinitiation of consultation was not triggered for any other species, the 2002 opinion remained in effect for all other listed species.

On June 8, 2006, two species of coral, elkhorn (*Acropora palmata)* and staghorn (*A. cervicornis*), were listed as threatened under the ESA. On November 26, 2008, a final rule designating critical habitat for these species was published in the Federal Register. On November 17, 2006, NMFS completed an informal section 7 consultation on the two newly listed species, finding that they were not likely to be adversely affected by the continued authorization of the federal Gulf of Mexico shrimp fishery. No consultation on the federal Gulf of Mexico shrimp fishery and its effects on *Acropora* critical habitat was ever conducted because the designation does not overlap with where that fishery is prosecuted. However, a small portion of the designated critical habitat area does occur where the federal South Atlantic shrimp fishery occurs. On May 1, 2009, NMFS completed an informal section 7 consultation on both of the listed coral species and their designated critical habitat for the South Atlantic shrimp fishery and determined they were not likely to be adversely affected by NMFS' continued authorization of the fishery.

Cause for Reinitiation and Present Consultation

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 ITS 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. Reinitiation of consultation on shrimp trawling was triggered for different geographic regions and for different species at different times. Thus, the present consultation combines several reinitiation requests and NMFS determinations as discussed below.

On May 4, 2009, the Sustainable Fisheries Division of NMFS, SERO (F/SER2) requested reinitiation of section 7 consultation on the South Atlantic federal shrimp fishery and its effects on smalltooth sawfish. The request was based on new observer data which indicated that the 2005 incidental take level of smalltooth sawfish had been exceeded. In the 2005 opinion for the South Atlantic shrimp fishery, NMFS had established an ITS allowing one lethal smalltooth sawfish take annually. No non-lethal takes were anticipated, thus none were authorized. During a March 5-9, 2009, trip in the South Atlantic EEZ, observers documented three smalltooth sawfish captures. One of the takes was lethal; the other two were released alive.

On February 18, 2010, F/SER2 requested reinitiation of section 7 consultation on the federal Gulf of Mexico shrimp fishery and its effects on Gulf sturgeon. The request was based on new information indicating that the fishery had unanticipated adverse effects on Gulf sturgeon. In the 2006 opinion, NMFS had concluded that Gulf sturgeon were not likely to be adversely affected by the Gulf of Mexico shrimp trawl fishery because the species stays mainly in state waters and only rarely occurs in federal waters. However, on December 15, 2009, observers from the Southeast Fisheries Science Center (SEFSC), Southeastern Shrimp Otter Trawl Observer Program documented a Gulf sturgeon captured in a shrimp trawl in federal waters of the Gulf of Mexico.

On March 9, 2010, F/SER2 requested reinitiation of section 7 consultation on the Gulf of Mexico shrimp fishery to address new information indicating that the 2006 ITS of smalltooth sawfish was exceeded. In the 2006 opinion for the Gulf shrimp fishery, NMFS had established an ITS allowing one smalltooth sawfish lethal take annually. On December 23, 2009, observers from the SEFSC, Southeastern Shrimp Otter Trawl Observer Program documented a smalltooth sawfish captured in a shrimp trawl. On February 18, 2010, observers documented a second smalltooth sawfish capture. Although both takes occurred in different calendar years, given the limited observer coverage in the Gulf shrimp fishery, the rate of observed captures suggested the ITS was likely exceeded by the fishery. Also, both observed captures were non-lethal, and no non-lethal takes had been authorized.

On August 16, 2010, the Southeast Regional Administrator determined reinitiation of section 7 consultation on shrimp trawling in the southeastern United States (i.e., state and federal waters) was necessary to address its effects on sea turtles. The determination was based on elevated strandings suspected to be attributable to shrimp trawling, compliance concerns with TED and tow-time regulations, and elevated nearshore sea turtle abundance trawl catch per unit of effort (CPUE). These factors collectively indicated that sea turtles may be affected by shrimp trawling, under the sea turtle conservation regulations and federal FMPs, to an extent not considered in the 2002 opinion. In the first three weeks of June 2010, over 120 sea turtle strandings were reported from Mississippi and Alabama waters, none of which exhibited any signs of external oiling to indicate effects associated with the Deepwater Horizon (DWH) oil spill event. Evidence of the lack of compliance with TED regulations, including the tow time provisions, cast doubt onto the actual effectiveness of the regulations in protecting and conserving sea turtles populations. There was also new information from the U.S. Army Corps of Engineers' sea turtle relocation trawling efforts indicating elevated CPUE of sea turtles in nearshore waters of Louisiana.

Formal section 7 consultation typically begins with a federal agency's written request and submission of a complete section 7 consultation initiation package. Formal consultation officially begins on the date on which all required information has been received. To comply with the section 7 regulations (50 CFR §402.14(c)), action agencies must include with their request for consultation all of the following:

- a description of the action being considered;
- a description of the specific area that may be affected by the action;
- a description of any listed species or critical habitat that may be affected by the action;
- a description of the manner in which the action may affect any listed species or critical habitat, and an analysis of any cumulative effects;
- relevant reports, including any environmental impact statements, environmental assessments, biological assessment or other analyses prepared on the proposal;
- and any other relevant studies or other information available on the action, the affected listed species, or critical habitat.

Both prior to and subsequent to F/SER2's requests for reinitiation of consultation on smalltooth sawfish and Gulf sturgeon and the determination that reinitiation of consultation was warranted for sea turtles, F/SER3 requested that the SEFSC provide shrimp trawl smalltooth sawfish bycatch estimates and updated sea turtle bycatch estimates. The requested estimates represented critical information needed for us to initiate the formal consultation process. On January 5, 2011, the SEFSC provided SERO with new sea turtle bycatch estimates for the Gulf of Mexico and southeastern Atlantic shrimp fisheries. On April 29, 2011, the SEFSC transmitted a report entitled, "Estimated Incidental Take of Smalltooth Sawfish and an Assessment of Observer Coverage Required in the South Atlantic and Gulf of Mexico Shrimp Trawl Fishery." Upon receipt of that report, F/SER3 considered the reinitiation of consultation package sufficient for analyzing effects on sea turtles and smalltooth sawfish so formal consultation was reinitiated.

New information critical to this opinion's analysis (particularly for sea turtles) continued to emerge during the consultation. The ESA allows for extension of the consultation period with concurrence of the action agency. As NMFS is both the action agency and the consulting agency, and there is no applicant associated with the proposed action, the consultation period was extended to the extent necessary for new data to be assessed and incorporated. During the extended consultation period F/SER3 worked extensively with the NOAA's NMFS Office of Law Enforcement (OLE) on estimating compliance with the TED regulations and with SEFSC Pascagoula experts on analyzing how those TED violations impacted the number of sea turtles captured and killed in shrimp trawls. F/SER3 also attempted to update the SEFSC sea turtle estimates for Southeast shrimp fisheries based on increases in the population sizes of Kemp's ridley and green sea turtles and the information on shrimp industry compliance with TED regulations.

On June 24, 2011, NMFS published a Notice of Intent in the Federal Register (76 FR 37050) regarding its intention to promulgate regulations to reduce the mortality of sea turtles in the shrimp fishery of the southeastern United States, initiating the scoping process. NMFS is preparing to publish the notice of availability for the Draft Environmental Impact Statement for this rulemaking and a proposed rule based on the DEIS's preferred alternative. Because the proposed rulemaking would change significantly the extent and the manner in which skimmer trawls interact with sea turtles, the proposed action for this opinion was modified to reflect and analyze the proposed rule. On February 6, 2012, five distinct population segments (DPS) of the Atlantic sturgeon that may be affected by the proposed action were listed under the ESA as endangered (76 FR 5914). The listing triggered the need to reinitiate on NMFS' continued implementation of the sea turtle conservation regulations applicable to shrimp trawling and its continued authorization of Southeast U.S. shrimp fisheries for these DPSs too.

In summary, this consultation is the culmination of several requests for reinitiation of consultation on different shrimp fisheries and listed species as the various triggers for reinitiation were met. With each reinitiation request and determination made, the scope of the proposed action and the species subject to reinitiation of section 7 consultation were expanded. The scope of the action and species subject to reinitiation of section 7 consultation were also expanded as triggered by a proposed change to the sea turtle conservation regulations and the listing of the two DPS of Atlantic sturgeon. This new opinion now covers NMFS' section 7 consultation responsibilities on both its implementation of sea turtle conservation regulations under the ESA as proposed to be amended, and its authorization of federal shrimp trawling under the MSA for all listed species. This opinion supersedes all previous determinations and opinions on southeastern shrimp trawl fisheries.

2.0 Description of the Proposed Action

NMFS is proposing to (1) continue to conserve sea turtles via its sea turtle conservation regulations under the ESA, which involve extending regulatory authorization to incidentally take sea turtles, subject to specific conditions, and (2) continue to authorize shrimp trawling in the EEZ under the South Atlantic and Gulf of Mexico Shrimp FMPs. In this section we describe both the existing and proposed sea turtles conservation regulations and southeastern shrimp fisheries and their management.

2.1 Sea Turtle Conservation Regulations Applicable to Shrimp Trawling In State and Federal Waters

The *Consultation History* section and Appendix 1 provide a complete chronology, with references, of the evolution of the sea turtle conservation regulations. The current sea turtle conservation regulations applicable to shrimp trawling are codified at 50 CFR sections 222.102, 223.205, 223.206, 223.207, and 224.104 and provided in Appendix 2.

General Requirements and Currently Approved TED Designs

Shrimp trawler means any vessel that is equipped with one or more trawl nets and that is capable of, or used for, fishing for shrimp, or whose on-board or landed catch of shrimp is more than 1 percent, by weight, of all fish comprising its on-board or landed catch. The incidental taking of sea turtles during shrimp trawling is exempted from the taking prohibition of section 9 of the ESA if the conservation measures specified in the sea turtle conservation regulations (50 CFR 223) are followed. The regulations require most shrimp trawlers operating in the southeastern United States (Atlantic and Gulf areas, see 50 CFR 223.206) to have a NMFS-approved TED installed in each net that is rigged for fishing to provide for the escape of sea turtles. TEDs incorporate an escape opening, usually covered by a webbing flap, which allow sea turtles to escape from trawl nets. To be approved by NMFS, a TED design must be shown to be 97 percent effective in excluding sea turtles during testing based upon specific testing protocols (50 CFR 223.207(e)(1)). "Hard" TEDs have rigid deflector grids. Approved hard are described TEDs in the regulations (50 CFR 223.207(a)) according to generic criteria based upon certain parameters of TED design, configuration, and installation, including height and width dimensions of the TED opening through which the turtles escape. "Soft" TEDs have deflector panels made from polypropylene or polyethylene netting. TEDs currently approved by NMFS include single-grid hard TEDs, hooped hard TEDs conforming to a generic description, and one type of soft TED – the Parker soft TED (see 50 CFR 223.207).

On February 21, 2003, NMFS issued a final rule (68 FR 8456) amending the sea turtle conservation regulations to protect large loggerhead, green, and leatherback sea turtles. The February 2003 final rule requires that all shrimp trawlers fishing in the offshore waters of the southeastern United States (Atlantic and Gulf areas) and the inshore waters of Georgia and South Carolina use either a double cover flap TED, a single-grid hard TED with a 71-inch (180-cm) opening, or a Parker soft TED with a 96-inch (244-cm) opening in each net rigged for fishing. In inshore waters, except those of Georgia and South Carolina, the rule allows the use of a single-grid hard TED with a 44-inch (112-cm) opening, a Parker soft TED with a 56-inch (142-cm) opening, and a hooped hard TED with a 35-inch (89-cm) by 27-inch (69-cm) escape opening.

Existing TED Exemptions and Special Permits
The existing sea turtle conservation regulations provide for limited exemptions to TED use, some of which require special permits.

Shrimp trawls currently may employ alternative tow time restrictions in lieu of TEDs in four circumstances, pursuant to 50 CFR 223.206(d)(2)(ii)(A) and (B). These regulations specify that a shrimp trawler that complies with alternative tow-time restrictions is exempt from TED requirements if it: (1) has on board no power or mechanical–advantage trawl retrieval system (i.e., any device used to haul any part of the net onboard; (2) is a bait shrimper that retains all live shrimp on board with a circulating seawater system, if it does not possess more than 32 pounds of dead shrimp aboard, if it has a valid original state bait-shrimp license, and if the state license allows the licensed vessel to participate in the bait shrimp fishery exclusively; (3) has only a pusher-head trawl, skimmer trawl, or wing net (butterfly trawl) rigged for fishing; or (4) is using a single test net (try net) with a headrope length of 12 ft or less and with a footrope length of 15 ft or less, if it is pulled immediately in front of another net or is not connected to another net in any way, if no more than one test net is used at a time, and if it is not towed as a primary net. The alternative tow time restrictions specified at 50 CFR 223.206 (d)(2)(i) limit tow times to 55 minutes from April 1 through October 31, and 75 minutes from November 1 through March 31.

NMFS has generally only allowed tow time use under the above limited circumstances because of fishermen compliance concerns. The four exemptions described above are for gears or fishing practices that, at least historically, out of physical, practical, or economic necessity, were thought to require fishermen to limit their tow times naturally.

NMFS also has the authority at 50 CFR 223.206(d)(3) to implement 30-day temporary notice actions that authorize the use of tow times in lieu of TEDs if: (1) the NOAA Assistant Administrator for Fisheries determines that environmental conditions (e.g., the presence of algae, seaweed, or debris) make TED use impracticable; or (2) the NOAA Assistant Administrator for Fisheries determines that TEDs do not work to protect sea turtles. NMFS has from time to time issued these temporary TED exemptions in response to post-hurricane debris problems or heavy, localized algae blooms (See Appendix 1). In issuing these exemptions, NMFS has consulted with the fishery management officials in the affected states (all previous TED exemptions have applied only to state waters) and received the commitment from the state to vigorously enforce the tow time limits.

For certain types of gears or fishing practices, the chance of capturing a turtle has been deemed low or non-existent, and these gears and fishing practices have been exempted from the TED requirements, even without tow time limits: (1) beam or roller trawls if the frame is outfitted with rigid vertical bars, spaced no more than 4" apart; and (2) shrimp trawlers fishing for or possessing royal red shrimp, if royal red shrimp make up at least 90 percent of the catch.

The existing sea turtle conservation regulations provide one additional means for issuing exemptions to the TED requirements. The Southeast Regional Administrator of NMFS may issue authorization letters to allow fishery research that would otherwise be subject to the TED requirements, and to fishermen or researchers to develop modified or new TEDs, subject to any conditions and restrictions he deems appropriate (50 CFR 223.207(e)(2)). For authorizations to conduct fishery research without TEDs, these restrictions invariably include a requirement to limit tow times, often to less than the 55/75 minutes allowed for shrimpers. Reporting of any sea turtle mortality is required as a condition of these authorizations. Research or gear testing TED exemptions represent a very small portion of shrimp trawl fishing effort, compared to the larger, shrimp fishery that is the main subject of the sea turtle conservation regulations.

TED exemptions issued to test experimental TEDs must meet a number of criteria prior to approval. Those criteria include the following: The experimental TED design must be significantly different in design from currently approved or previously tested TEDs; the NMFS Harvesting Systems Branch and F/SER3 must believe that the experimental TED has the potential to improve TED performance, and its ability to exclude sea turtles is not likely to be lower than currently approved TEDs; the applicant must not have a history of violations of the sea turtle conservation regulations; and if the applicant has previously been issued an exemption (or exemptions) under these regulations, he/she must have filed a report to NMFS on the outcome of the exempted TED testing. The Southeast Regional Administrator may also issue exemptions to many fishermen at the same time to facilitate the wide range testing of certain experimental designs. These exemptions are issued for TED designs that the Harvesting Systems Branch believes show promise for increased performance and have already been tested on a smaller scale.

Proposed Change to Existing TED Exemptions

NMFS is proposing to withdraw the alternative tow time restriction at 50 CFR 223.206(d)(2)(ii)(A)(*3*) for skimmer trawls, pusher-head trawls, and wing nets (butterfly trawls) and instead require all of these vessels to use TEDs. Information from NMFS and Mississippi Department of Marine Resources (MDMR) enforcement, stemming from the monitoring of Mississippi Sound skimmer trawl vessels in 2010, indicate the alternative tow time requirements are exceeded by vessels in the skimmer trawl fleet. They noted that some were not even aware of the tow time restrictions. Furthermore, it has been over 10 years since this segment of the fishery has been evaluated and given the apparent increased abundance of sea turtles in the Northern Gulf of Mexico, particularly Kemp's ridley sea turtles, NMFS determined that a review on the efficacy of alternative tow time restrictions used by skimmer trawls to reduce sea turtle mortality was prudent. The proposed change is intended to reduce incidental bycatch and mortality of sea turtles in the Southeastern U.S. shrimp fisheries, and to aid in the protection and recovery of listed sea turtle populations.

Other Applicable Sea Turtle Conservation Regulations

NMFS has the authority under the ESA and the implementing regulations at 50 CFR 223.206(d)(4) to implement 30-day emergency restrictions to respond to sea turtle takings that would violate the restrictions, terms, or conditions of an incidental take statement, opinion, or incidental take permit or that may be likely to jeopardize the continued existence of any listed species. NMFS has used this authority many times (as shown in the chronology of section 7 consultations and Appendix 1).

NMFS requires detailed handling and resuscitation techniques be used for sea turtles that are incidentally caught during scientific research or fishing activities. As stated in §223.206(d)(1-3), resuscitation must be attempted on sea turtles that are comatose or inactive by:

1. Placing the sea turtle on its bottom shell (plastron) so that the sea turtle is right side up and elevating its hindquarters at least six inches for a period of 4 to 24 hours. The amount of elevation depends on the size of the sea turtle; greater elevations are needed for larger sea turtles. Periodically, rock the sea turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about three inches then alternate to the other side. Gently touch the eye and pinch the tail (reflex test) periodically to see if there is a response.
2. Sea turtles being resuscitated must be shaded and kept damp or moist but under no circumstance be placed into a container holding water. A water-soaked towel placed over the head, carapace, and flippers is the most effective method in keeping a sea turtle moist.
3. Sea turtles that revive and become active must be released over the stern of the boat only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels. Sea turtles that fail to respond to the reflex test or fail to move within four hours (up to 24, if possible) must be returned to the water in the same manner as that for actively moving sea turtles.
4. A sea turtle is determined to be dead if the muscles are stiff (rigor mortis) and/or the flesh has begun to rot; otherwise, the sea turtle is determined to be comatose or inactive and resuscitation attempts are necessary.
5. Any sea turtle so taken must not be consumed, sold, landed, offloaded, transshipped, or kept below deck.

2.1.1 Managing the Effectiveness of TEDs via Compliance Standards

An important factor in the effectiveness of the sea turtle conservation regulations has always been fleet compliance. The extent and severity of regulatory violations play a major role in how successful the sea turtle conservation regulations are at conserving sea turtles. Shrimp trawls when equipped with TEDs compliant with the sea turtle conservation regulations are 97 percent effective, meaning they have a 3 percent sea turtle capture rate (i.e., 3 out of 100 sea turtles entering a trawl are captured). When TEDs are not installed properly, their effectiveness can be reduced and in severe cases (e.g., TED opening sewn shut) completely compromised (i.e., have a 100 percent capture rate). Because sea turtle interaction rates in shrimp trawls show interactions are not nearly as rare as in other managed fisheries, lack of compliance, even by a relatively small portion of the fleet, can have dramatic results on overall sea turtle mortality levels, and poor compliance with these regulations has previously resulted in NMFS issuing a jeopardy opinion (e.g., NMFS (1994)).

The OLE, U.S. Coast Guard (USCG), and Gulf and South Atlantic States, with the exception of Louisiana (under Joint Enforcement Agreements), all enforce the sea turtle conservation measures. Enforcement activities are aided by the SEFSC Gear Monitoring Team (GMT) who provide TED technical training programs for all of these law enforcement officers. The GMT also conducts extensive training and outreach to shrimp fishermen and TED net shops and participates in enforcement boarding activities to maximize positive information exchange with fishermen and to identify and correct technical difficulties in the field.

In conducting this consultation, SERO worked extensively with OLE and the GMT to gather the best available information on the extent of compliance with these regulations in the past. Based on that information (described later in Section 5.1.3.2), which indicates compliance and capture rates have fluctuated over the years, NMFS believes setting a compliance standard is essential for TEDS to be effective in minimizing sea turtle mortality as intended. Based on May through December 2011 documented compliance rates in the Gulf of Mexico, the extent of those violations, and analysis of the effects, NMFS is proposing to monitor and ensure compliance with the sea turtle conservation regulations at a level that would keep sea turtle catch rates of shrimp trawls required to use TEDs at or below 12 percent of all sea turtle interactions (please see Section 5.1.3.2 for details on this capture rate). Compliance will be monitored using data collected by SEFSC GMT, the SEFSC observer program, NMFS enforcement, USCG and state enforcement agencies.

2.2 Southeastern Shrimp Fisheries

Southeastern shrimp fisheries various species of shrimp at various stages of their lifecycle using a variety of vessels that range from ocean-going trawlers to small vessels operating in nearshore waters. Magnuson et al. (1990) provided an overview of its occurrence and distributions: "About one-third of shrimp effort in the Southeast occurs in bays, rivers, and estuaries; two-thirds occurs outside the coastline. Ninety-two percent of the total effort is in the Gulf [of Mexico] with most of that effort in waters shallower than 27 m. The fishing areas off the coastal beaches of Texas and Louisiana account for 55 percent of the total U.S. effort and 83 percent of the effort off the coastal beaches. In the Atlantic, 92 percent is within 5 km of shore. Atlantic shrimping effort is concentrated off South Carolina, Georgia, and northern Florida." While these statistics are dated, given shrimp production and lifecycles have not changed over the years, this characterization generally still describes how southeastern shrimp trawl fisheries are distributed in the Southeast.

Harvested shrimp species include brown shrimp (*Farfantepenaeus aztecus*), white shrimp (*Litopenaeus setiferus*), pink shrimp (*Farfantepenaeus duorarum*), royal red shrimp (*Hymenopenaeus robustus)*, and rock shrimp (*Sicyonia brevirostris*). Brown, white, and pink shrimp are subjected to fishing from inland waters and estuaries, through the territorial seas, and into the federal waters of the EEZ and constitute the majority of the harvest in both the Gulf of Mexico and the South Atlantic. Pink and brown shrimp are primarily caught at night when they are most active. White shrimp are primarily caught during the day. Penaeid shrimp are short-lived, essentially an annual crop, and have an ever changing size distribution. Early shrimp development takes place in inshore nursery areas. Later, after reaching a larger size, they migrate seaward. Prior to the onset of maturation, shrimp begin moving from inshore habitats to higher salinity offshore waters. Rock shrimp are primarily harvested as bycatch in brown and pink shrimp fisheries, but a small targeted fishery exists off Northeast Florida along the shelf edges at depths of approximately 61 to 91m (200-300 ft). Royal red shrimp occur only in the very deep waters of the South Atlantic and Gulf of Mexico EEZ (238-549 m). Royal red shrimp are not annual stock, and live longer; several year classes may occur on the grounds at one time.

The condition of each shrimp stock is monitored annually, and none have ever been declared as being overfished because of excessive fishing mortality[1].

2.2.1 Shrimp Fishing Gear

Various types of gear are used to capture shrimp including otter trawls, wing nets (butterfly nets), skimmer trawls, pusherhead trawls (chopstick rigs), stationary butterfly nets, beam trawls, roller-frame trawls, cast nets, channel nets, haul seines, traps, and dip nets. The otter trawl, with various modifications, is the dominant gear used in offshore waters and essentially the sole gear used in the federal fisheries. Otter trawls are also used for inshore bait shrimping off the states of Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas, but under trawl size and area restrictions. Trawls are the only authorized gear under the South Atlantic FMP. Authorized gear types listed for the Gulf of Mexico FMP include trawl, butterfly net, skimmer, and cast net for commercial use and trawl only for the recreational use. The other gear types listed above are really used only in state waters and almost exclusively within inshore waters. Below we describe the gear types that NMFS authorizes or modifies via the sea turtle conservation regulations and may adversely affect listed species (i.e., otter trawls, skimmer trawls, and wing nets (butterfly nets).

Figure 1 (see next page) illustrates a typical otter trawl configuration and its components.
A basic otter trawl consists of a heavy mesh bag with wings on each side designed to funnel the shrimp into the "cod end" or "tail bag." A pair of otter boards or trawl doors positioned at the end of each wing holds the mouth of the net open by exerting a downward and outward force at towing speed. A lead line or footrope extends from door to door on the bottom of the trawl, while a cork line or headrope is similarly attached at the top of the net. A "tickler chain" is also attached between the trawl doors; it runs just ahead of the net, and is used to spook shrimp off the bottom and into the trawl net. The lead lines of larger nets are weighted with a 1/4-to 3/8-inch loop chain attached at about 1-foot intervals with a 14- to 16-inch drop. Many larger nets are also equipped with rollers on the lead line that keeps the lead line from digging into muddy bottom.

Shrimp trawl nets are usually constructed of nylon or polyethylene mesh webbing, with individual mesh sizes ranging from 1-1/4" to 2". The sections of webbing are assembled according to the size and design (usually flat, balloon, or semi-balloon) of trawl desired, which affects the width and height of the trawl's opening and its bottom-tending characteristics. The tongue or "mongoose" design incorporates a triangular tongue of additional webbing attached to the middle of the headrope pulled by a center towing cable, in addition to the two cables pulling the doors. This configuration allows the net to spread wider and higher than conventional nets and as a result has gained much popularity for white shrimp fishing.

[1] Although the South Atlantic pink shrimp stock was listed as overfished in 2008 and the Gulf of Mexico pink shrimp stock in 2009, pink shrimp is an annual crop so no rebuilding plan was required (NMFS 2008, 2009—stock status reports, available on line). A panel of experts determined that the stock was overfished due to environmental factors rather than overfishing (NMFS 2009).

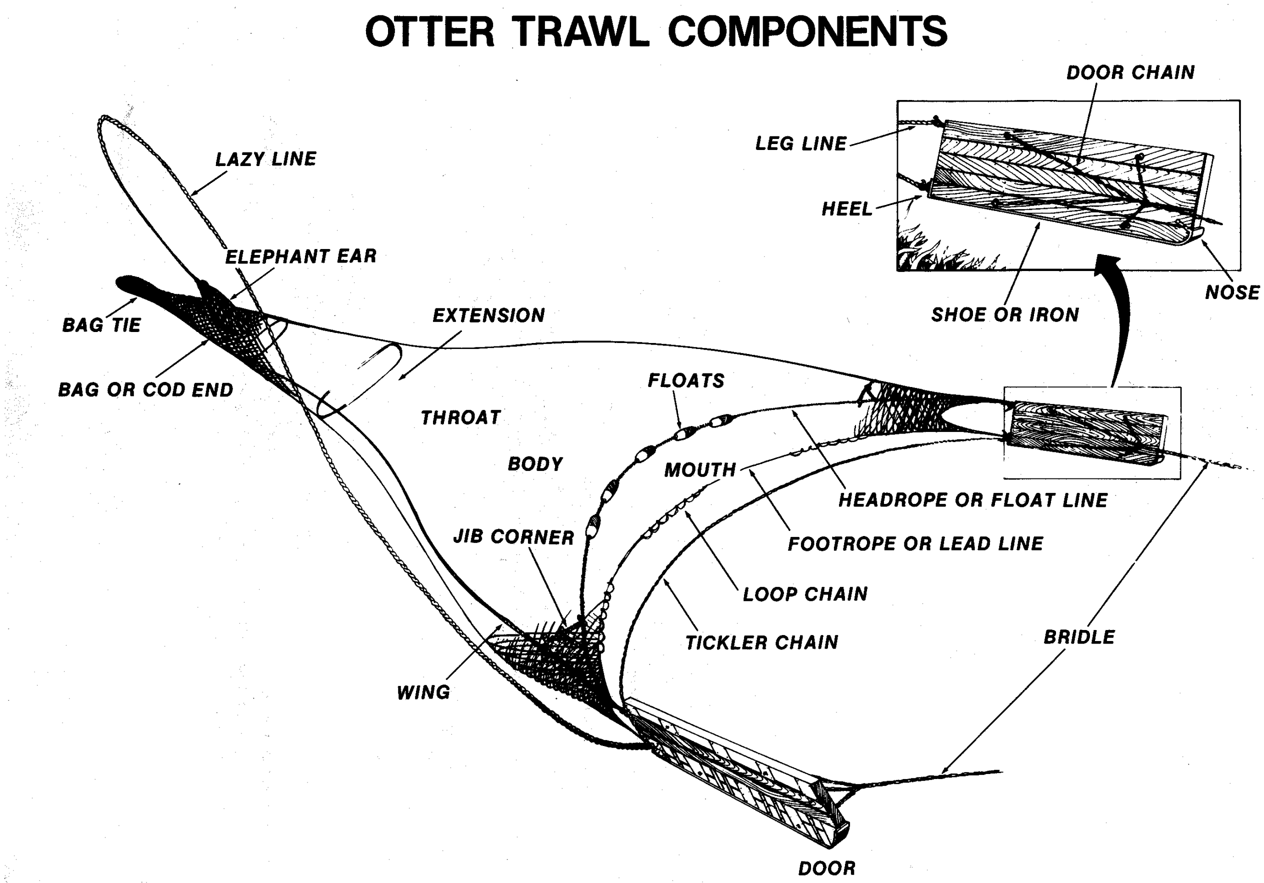

Figure 1: Schematic of an otter trawl and its components

Until the late 1950s, most shrimp vessels pulled single otter trawls, ranging from 80 to 100 feet in width, directly astern of the boat. Double-rig trawling was introduced into the shrimp fleet during the late 1950s. The single large trawl was replaced by two smaller trawls, each 40 to 50 feet in width, towed simultaneously from stoutly constructed outriggers located on the port and starboard sides of the vessels. The advantages of double-rig trawling include: (1) increased catch per unit of effort, (2) fewer handling problems with the smaller nets, (3) lower initial gear costs, (4) reduced costs associated with damage or loss of the nets, and (5) greater crew safety.

The quad rig was introduced in the shrimp fishery in 1972, and by 1976 it became widely used in the EEZ of the western Gulf. The quad rig consists of a twin trawl pulled from each outrigger. One twin trawl typically consists of two 40- or 50-foot trawls connected to a center sled and spread by two outside trawl doors. Thus, the quad rig with two twin trawls has a total spread of 160-200 feet versus the total spread of 110 feet in the old double rig of two 55-foot trawls. The quad rig has less drag and is more fuel efficient. The quad rig is the primary gear used in federal waters by larger vessels. As of July 25, 2011, there were 1,553 Gulf of Mexico federal shrimp fishery permits. Smaller boats and inshore trawlers often still use single- or double-rigged nets.

Try nets are about 12 to 16 feet in width and used to test areas for shrimp concentrations. These nets are towed during regular trawling operations and lifted periodically to allow the fishermen to assess the amount of shrimp and other fish and shellfish being caught. These amounts in turn determine the length of time the large trawls will remain set or whether more favorable locations will be selected.

Butterfly nets (wing nets or “paupiers”) were introduced in the 1950s and used on stationary platforms and on shrimp boats either under power or while anchored. A butterfly net consists of a square metal frame which forms the mouth of the net. Webbing is attached to the frame and tapers back to a codend. The net can be fished from a stationary platform or a pair of nets can be attached to either side of a vessel. The vessel is then anchored in tidal current or the nets are “pushed” through the water by the vessel.

Vietnamese fishermen began moving into Louisiana in the early 1980s and introduced a gear called the "xipe" or "chopstick" net (i.e., pusher head trawls) around 1983. Also known as pusher head trawls, the chopstick was attached to a rigid or flexible frame similar to the butterfly net; however, the frame mounted on the bow of the boat was attached to a pair of skids and fished by pushing the net along the bottom. As with butterfly nets, the contents of the net could be picked up and dumped without raising the entire net out of the water as is necessary with an otter trawl.

The skimmer trawl was developed for use in some areas primarily to catch white shrimp, which has the ability to jump over the cork line of standard trawls while being towed in shallow water. The skimmer net frame allows the net to be elevated above the water while the net is fishing, thus preventing shrimp from escaping over the top. Owing to increased shrimp catch rates, less debris or bycatch, and lower fuel consumption experienced by otter trawlers, the use of skimmer nets quickly spread throughout Louisiana, Mississippi, and Alabama.

Figures 2 and 3 illustrate the basic components of a skimmer trawl from different angles for better understanding of their design. The basic components of a skimmer trawl include a frame, the net, heavy weights, skids or “shoes,” and tickler chains. The net frame is usually constructed of schedule 80 steel or aluminum pipe or tubing and is either L-shaped (with an additional stiff leg) or a trapezoid design. When net frames are deployed, they are aligned perpendicularly to the vessel and cocked or tilted forward and slightly upward. This position allows the net to fish better and reduces the chance of the leading edge of the skid digging into the bottom and subsequently damaging the gear. The frames are maintained in this position by two or more stays or cables to the bow. The outer leg of the frame is held in position with a “stiff leg” to the horizontal pipe and determines the maximum depth at which each net is capable of working. To the bottom of the outer leg is attached the skid or “shoe,” which allows the frame to ride along the bottom, rising and falling with the bottom contour. Tickler chains and lead lines comprise the bottom of this gear. Under the proposed action, skimmer trawls are required to use TEDs. The proposed action does not require bycatch reduction devices (BRDs) in skimmer trawls, but models do exist that can be used voluntarily.

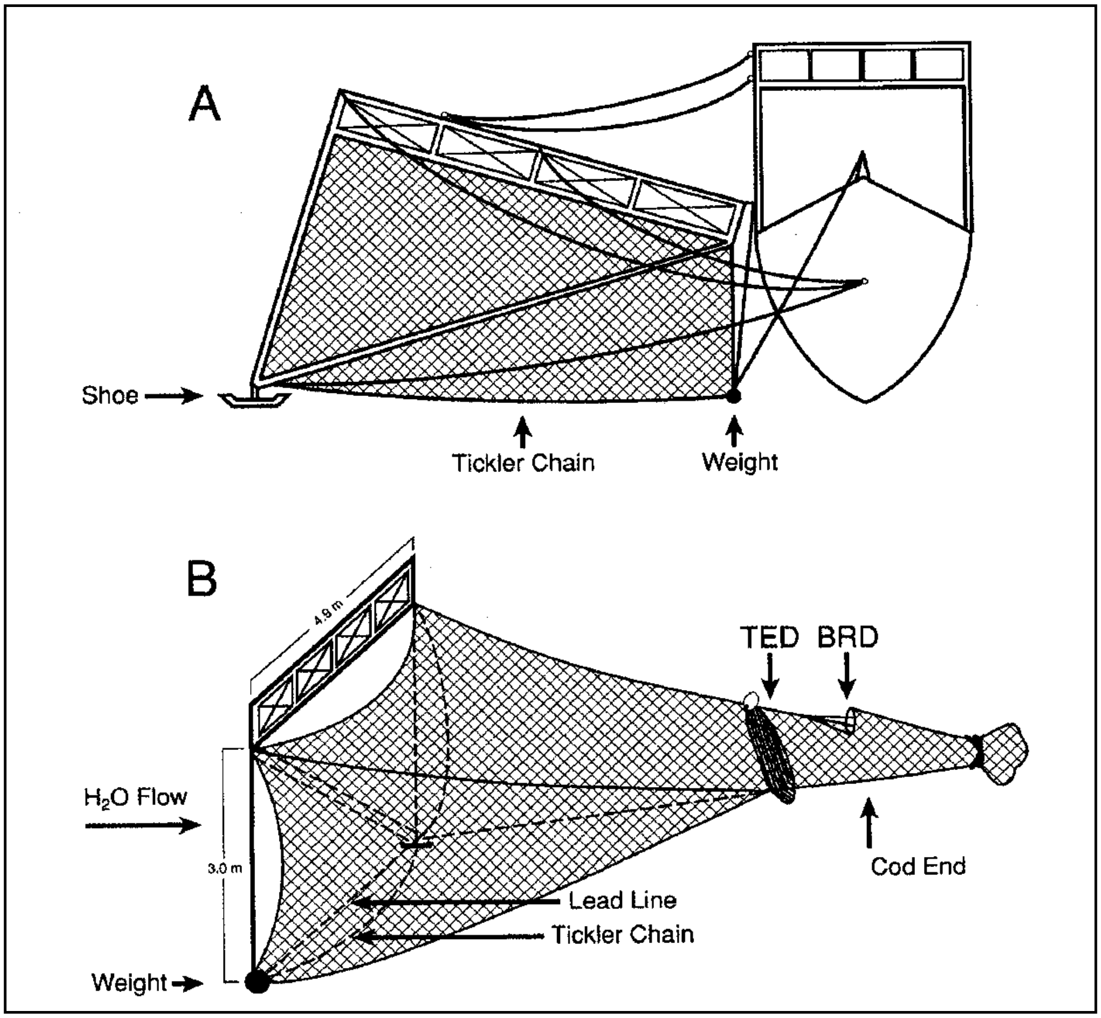

Figure 2. Skimmer trawl diagram showing (A) the skimmer trawl frame viewed from the bow of the vesselnd (B) the components of the net, including an installed TED and BRD (from Warner et al. 2004)

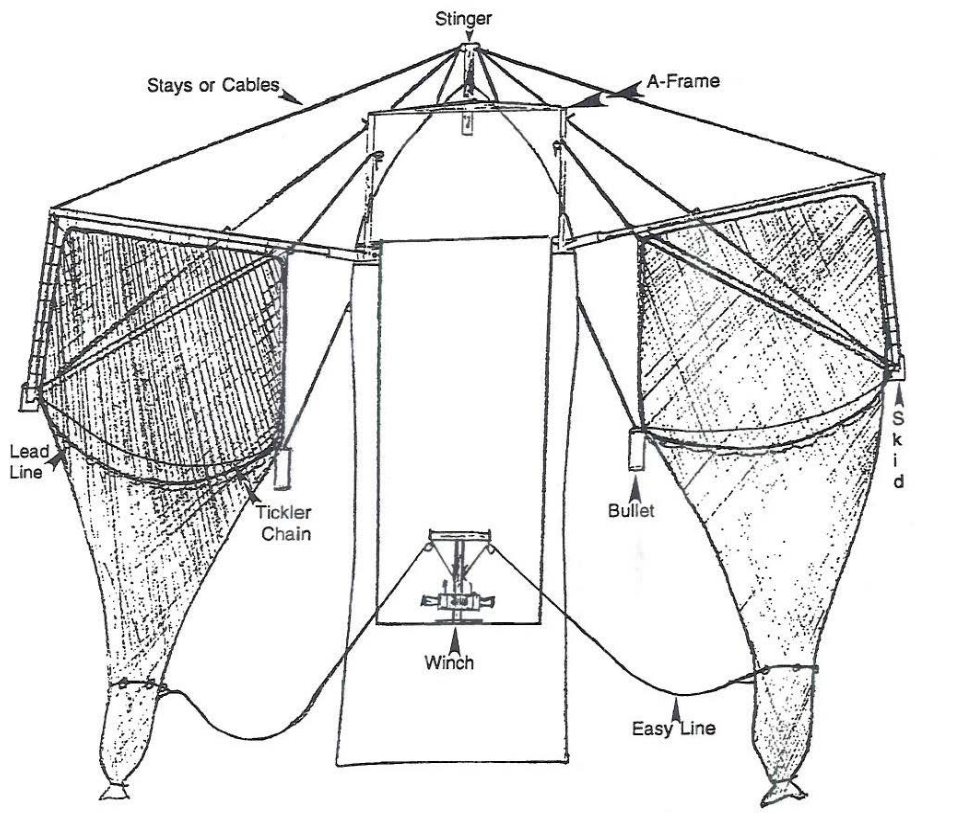

Figure 3. Schematic of a skimmer trawl and its components viewed from overhead (from Hein and Meir 1995)

All Gulf of Mexico states except Texas include skimmer trawls as an allowable gear. In recent years, the skimmer trawl has become a major gear in the inshore shrimp fishery in the Northern Gulf and also has some use in inshore North Carolina. Louisiana hosts the vast majority of skimmer boats, with 2,248 skimmer and butterfly net trawlers reporting landings in 2008 (Gulf Shrimp System statistics). In 2008, Mississippi had approximately 62 active skimmer, butterfly, and chopstick boats (M. Brainard, Mississippi Division of Marine Resources (MDMR), pers. comm.), Alabama had 60 active skimmer boats (Gulf Shrimp System statistics), and North Carolina had 97 skimmer vessels (North Carolina Division of Marine Fisheries (NCDMF) statistics). Skimmer vessels in North Carolina have declined in recent years to 64 active vessels in 2010 (NCDMF statistics).

A beam trawl is defined as a trawl with a rigid frame surrounding the mouth that is towed from a vessel by means of one or more cables or ropes. A shrimp trawl net is attached at the mouth to a rigid pole, beam, or frame to maintain spread; no trawl boards or spreading devices are used. Beam trawls are reportedly only used in Texas, where they are an allowable gear for table and bait shrimp in inshore waters only. Their actual use is believed to be minimal. The gear is restricted in size to no more than 25 feet in total width. A beam trawl may be used as a try net in Texas when it is limited to 5 feet in total width.

A roller trawl is variety of beam trawl that is used by small vessels for fishing for live-bait shrimp (typically at night) over uneven or vegetated sea bottoms. The use of roller trawls is limited to Florida with no other states reporting this gear type (Epperly et al. 2002). Roller trawls are allowed throughout the state of Florida, but only are used in areas of seagrass and hard bottom. Roller frame trawls, which usually fish in waters less than 25 feet, utilize a rectangular frame construction with vertical bars in the area of the frame. As the trawl is towed, the frame keeps the net open as it rides along the bottom on metal rollers. Because of the spacing on the vertical bars, larger animals are deflected away from the net and only small shrimp, invertebrates, and fish are captured. Roller frame tows average 12 to 30 minutes (Florida Fish and Wildlife Commission, Florida Wildlife and Research Institute (FWRI), unpublished report available at: http://www.nmfs.noaa.gov/pr/pdfs/strategy/fl_gulf_trawl_gear.pdf).

2.2.2 U.S. Gulf of Mexico Shrimp Fishery

The Final Environmental Impact Statement (EIS) for the original Gulf shrimp FMP and the FMP as revised in 1981 contain a description of the Gulf shrimp fishery. This material is incorporated by reference and is not repeated here in detail. Amendments 9 (GMFMC 2007), 13 (GMFMC and NMFS 2005) and 14 (GMFMC 2007) include a Supplemental EIS updating this information. The following information is provided as an overview and is excerpted from the FMP or summarized from Amendment 13 and 14 to Gulf Shrimp FMP prepared by the GMFMC.

The Gulf Shrimp FMP management unit includes brown, white, pink, and royal red shrimp. Seabobs and rock shrimp are not managed under the FMP, but occur as incidental catch in the fishery.

Brown shrimp are the most important species in the U.S. Gulf fishery. In the U.S. Gulf of Mexico, catches are high along the Texas, Louisiana, and Mississippi coasts. Brown shrimp are caught out to at least 50 fathoms, though most catch comes from waters less than 30 fathoms. The season begins in May with principal catches made from June through October (with peaks in June and July) and gradually declines to an April low.

White shrimp range along the Gulf coast from the mouth of the Ochlockonee River, Florida, to Campeche, Mexico. They are second in value and are found in nearshore waters to about 20 fathoms. White shrimp are comparatively shallow-water shrimp, with most of the catch coming from less than 15 fathoms. There is a small spring and summer fishery for overwintering individuals, but the majority of shrimp are taken from August through December.

Pink shrimp are found off all Gulf states but are most abundant off Florida's west coast and particularly in the Tortugas grounds off the Florida Keys. Most landings are made from October through May. In the western Gulf states, pink shrimp are landed mixed with browns. Most pink catches are made within 30 fathoms, with a peak catch at 11 to 15 fathoms.

A commercial fishery for royal red shrimp expanded in the late 1990’s with the development of local markets. This deep-water species is most abundant on the continental shelf from about 140 to 275 fathoms east of the Mississippi River.

Management measures implemented under the MSA apply only to federal waters of the EEZ. Cooperative management occurs when state and federal regulations are consistent. Examples are the seasonal closure off Texas, the Tortugas Shrimp Sanctuary, and the shrimp/stone crab seasonally closed zones off Florida.

NMFS has classified commercial shrimp vessels comprising the nearshore and offshore fleet into size categories from under 25 feet to over 85 feet. Based on the data available, more than half fall into a size range from 56 to 75 feet.

Federal permits for shrimp vessels have been required since December 5, 2002. A moratorium on federal shrimp permits was approved by the GMFMC in 2005. As of April 17, 2012, there were 1,465 federally-permitted (limited access) Gulf of Mexico shrimp vessels, which is a significant decline from the 2,385 vessels encompassed by a previously open-access Gulf of Mexico federal shrimp permit, which sunset on March 25, 2007 (NMFS statistics). State license requirements vary. Many vessels maintain licenses in several states because of their migratory fishing strategy. The number of vessels at any one time varies due to economic factors such as the price and availability of shrimp and cost of fuel.

NMFS estimates fishing effort independently from the number of vessels fishing. NMFS has historically used the number of hours actually spent fishing from interview data with vessel captains to develop reports as 24-hour days fished. These estimates have been controversial and not well understood because the effort reported does not necessarily reflect the number of active vessels in the fleet. In recent years, this data is supplemented and refined with electronic logbook (ELB) data to determine total net hours and geographic areas fished (J. Nance, SEFSC, pers. comm.)

A recreational shrimp trawl fishery occurs seasonally and almost entirely in the inside waters of the states. There are about 8,000 small boats participating using trawls up to 16 feet in width. About half the boats are licensed in Louisiana.

2.2.3 U.S. South Atlantic Shrimp Fishery

The Final EIS for the original South Atlantic Shrimp FMP and the original South Atlantic Shrimp FMP contain a description of the shrimp fishery. This material is incorporated by reference and is not repeated here in detail. The following information is summarized or excerpted from the Final Ecosystem Plan (SAFMC 2009a) and the Comprehensive Ecosystem-Based Amendment 1 (SAFMC 2009b).

The shrimp fishery is the largest and most valuable commercial fishery in the South Atlantic area, with approximately 1,400 large vessels and 1,000 small boats in 1994. Penaeid shrimp constitute the majority of the harvest occurring from coastal, near-shore, and estuarine waters off the states of North Carolina through southeast Florida. The commercial fishing area for Penaeid shrimp is mainly concentrated from Pamlico Sound and Ocracoke Inlet, North Carolina, to Fort Pierce, Florida. Rock shrimp (*Sicyonia brevirostris*) is concentrated primarily in Florida from Fernandina Beach to south of Cape Canaveral to Melbourne. Royal red shrimp are not managed under the South Atlantic Shrimp FMP, but are targeted by the same fishermen that harvest rock shrimp with the same gear and vessels.

White shrimp begin moving seaward from their inshore nursery areas through the summer and fall with a gradient of increasing size from fresh water to water of higher salinity. They begin entering the commercial catch in high salinity water at about 90 mm (3.5 in). In North Carolina, white shrimp begin entering the commercial fishery in July and continue to be caught through December. In Florida, white shrimp leave inshore waters at about 120 mm (4.7 in). Brown shrimp first enter the commercial fishery in North Carolina in June at about 100 mm. Movement of brown shrimp appears to take place primarily at night. Pink shrimp leave Florida estuaries two to six months after having arrived as post-larvae. Shrimp that overwinter in estuaries migrate to sea in May and June, at which time spawning takes place. Recruitment to the area offshore of Cape Canaveral begins in April and May and again during October and November.

The contribution of each species to total shrimp landings in the South Atlantic varies in a relatively consistent pattern among the four states. Shrimp landings vary seasonally, governed primarily by the life cycles of the particular species. The peak shrimping season generally runs from July through October.

In North Carolina, brown shrimp is the principal species while white shrimp is a minor component of the overall catch, with pink shrimp sometimes being an important component of the catch, and rock shrimp constituting a minor component of any year’s catch. In North Carolina, commercial quantities of pink shrimp appear in early spring with peak catches usually in mid-May. By mid-July, the season for brown shrimp reaches its peak and continues until late fall, when shrimp leave coastal waters. Relatively small catches of white shrimp occur in the Southport-Cape Fear area in North Carolina in fall.

In South Carolina and Georgia, there are virtually no pink shrimp in the landings, which are dominated by white shrimp. The relative contribution of brown shrimp to the catch varies yearly, but rarely exceeds the catch of white shrimp. Rock shrimp landings in recent years have been either nonexistent or minimal for South Carolina and constitute a low percentage of total shrimp catch for Georgia vessels. In South Carolina, overwintering white shrimp usually appear in early spring, with the season generally opening in May. These roe shrimp will be fished until June or early July when brown shrimp begin to occur in offshore waters. Brown shrimp will be fished until early autumn at which time white shrimp predominate in the catch until the fishery closes in December. In Georgia, the seasonality of the fishery is similar to South Carolina.

On the east coast of Florida, the fishery is dominated by white shrimp, which may be available as late as March in central Florida. In Northeast Florida, some pink shrimp enter the catch, primarily as a bycatch of the rock shrimp fishery, but as in Georgia and South Carolina, white shrimp predominate in terms of value. In recent years, landings of rock shrimp have become an increasing component of shrimp landings in Florida. The peak rock shrimp season generally occurs from July through October (SAFMC 2002a).

In order to stay productive year round, many commercial fishermen participate in other types of fisheries when not shrimping. Fisherman migration is an additional adaptation to the seasonal nature of the shrimp fishery. Rather than switch over to other fisheries available to them locally, some shrimpers choose to temporarily migrate to other states or regions with greater abundance of shrimp.

Recreational and commercial bait shrimp fisheries also exist in the South Atlantic area, in state waters.

2.3 Shrimp Fishery Management in the EEZ

In the Gulf, royal red shrimp are targeted and thus managed under the Gulf Shrimp FMP. Rock shrimp are not managed under the Gulf Shrimp FMP, but can occur as incidental catch in the fishery. In contrast, in the South Atlantic rock shrimp that are targeted and managed under the South Atlantic Shrimp FMP; royal red shrimp are not a managed species in the South Atlantic, but are caught by fishermen targeting rock shrimp.

Management requirements under MSA in federal waters include vessel permits, with a moratorium on new Gulf commercial shrimp permits; reporting requirements, mandatory observer coverage if selected by NMFS, time-area closures to protect juvenile red snapper caught as bycatch, gear restrictions, and requirements for certified bycatch reduction devices.

White shrimp harvested in the EEZ are subject to the minimum-size landing and possession limits of Louisiana when possessed within the jurisdiction of that State. There are no other federal size or trip limits on shrimp target species. However, there is an annual quota for royal red shrimp in the Gulf. Additionally, shrimp trawls aboard may not exceed recreational reef fish bag limits. Closed areas and established marine reserves are used to protect habitat and nursery areas of shrimp and other species. Weak links on tickler chains are required to prevent hanging up on hard substrates.

Logbooks are not required on every vessel, but a random sample of vessels is selected each year to carry observers and to use electronic logbooks. Additionally, in the Gulf of Mexico a vessel and gear characterization form must be completed and submitted annually.

Federal management actions are designed mainly to address economic and bycatch issues more so than stock abundance. The stock abundance for pink, brown, and white shrimp is driven by environmental conditions rather than parent stock size with stock sizes observed. These shrimp species are all extremely short-lived (18-24 months) and fecund (spawning 215,000-1 million eggs every three days) making them generally inherently resilient to fishing pressure. However, the fishery does have the ability to cause growth overfishing, and seasonal closures (e.g., the Texas closure) are used to delay fishing until the shrimp reach a larger, more economically valuable size.

2.3.1 History of Management Plans and Amendments of the Gulf Shrimp Fishery

The fishery for shrimp in the Gulf EEZ is managed under the Gulf Shrimp FMP. The FMP was prepared by the GMFMC, approved by NMFS, and implemented under the authority of the MSA by regulations on May 15, 1981, at 50 CFR part 622. The goal of the plan was to enhance yield in volume and value by deferring harvest of small shrimp to provide for growth. Management measures included: (1) establishment of a cooperative Tortugas Shrimp Sanctuary with the state of Florida to close a shrimp trawling area where small pink shrimp comprise the majority of the population most of the time; (2) a cooperative 45-day seasonal closure with the state of Texas to protect small brown shrimp emigrating from bay nursery areas; and (3) seasonal zoning of an area of Florida Bay for either shrimp or stone crab fishing to avoid gear conflict.

Amendment 1, approved later that year, provided the Southeast Regional Administrator of NMFS with the authority (after conferring with the GMFMC) to adjust by regulatory amendment the size of the Tortugas Sanctuary or the extent of the Texas closure, or to eliminate either closure for one year.

Amendment 2 (1983) updated catch and economic data in the FMP.

Amendment 3 (1984) resolved a shrimp-stone crab gear conflict on the west-central coast of Florida.

Amendment 4, which was partially approved in 1988 and finalized in 1989, revised the objectives of the FMP to reflect problems that had developed in the fishery. The annual review process for the Tortugas Sanctuary was simplified, and the GMFMC's and Regional Administrator's review for the Texas closure was extended to February 1st. Disapproved was a provision that white shrimp taken in the EEZ be landed in accordance with a state's size/possession regulations to provide consistency and facilitate enforcement with the state of Louisiana. This latter action was to have been implemented at such time when Louisiana provided for an incidental catch of undersized white shrimp in the fishery for seabobs. This proposed action was disapproved by NMFS with the recommendation that it be resubmitted under the expedited 60-day Secretarial review schedule after Louisiana provided for a bycatch of undersized white shrimp in the directed fishery for seabobs. This resubmission was made in February of 1990 and applied to white shrimp taken in the EEZ and landed in Louisiana. It was approved and implemented in May of 1990.

In July 1989, NMFS published revised guidelines for FMPs that interpretively addressed MSA National Standards (50 CFR Part 602). These guidelines required each FMP to include a scientifically measurable definition of overfishing and an action plan to arrest overfishing should it occur.

In 1990, Texas revised the period of its seasonal closure in Gulf waters from June 1 to July 15 to May 15 to July 15. The FMP did not have enough flexibility to adjust the cooperative closure of federal waters to accommodate this change, thus an amendment was required.

Amendment 5, approved in 1991, defined overfishing for Gulf brown, pink, and royal red shrimp and provided for measures to restore overfished stocks if overfishing should occur. Action on the definition of overfishing for white shrimp was deferred, and seabobs and rock shrimp were deleted from the management unit. The duration of the seasonal closure to shrimping off Texas was adjusted to conform to the changes in state regulations.

Amendment 6 (1993) eliminated the annual reports and reviews of the Tortugas Shrimp Sanctuary in favor of monitoring and an annual stock assessment. Three areas within the sanctuary continued to open seasonally, without need for annual action. A proposed definition of overfishing of white shrimp was rejected by NMFS as not being based on the best available data.

Amendment 7, finalized in 1994, defined overfishing for white shrimp and provided for future updating of overfishing indices for brown, white, and pink shrimp as new data become available. A total allowable level of foreign fishing for royal red shrimp was eliminated; however, a redefinition of overfishing for this species was disapproved.

Amendment 8, submitted in 1995 and implemented in early 1996, addressed management of royal red shrimp. It established a procedure that would allow total allowable catch for royal red shrimp to be set up to 30 percent above maximum sustainable yield (MSY) for no more than two consecutive years so that a better estimate of MSY could be determined. This proposal was subsequently rejected by NMFS because the Sustainable Fisheries Act defined exceeding MSY as overfishing.

Amendment 9, with Supplemental EIS, approved in May 1998, required the use of NMFS certified BRDs in shrimp trawls used in the EEZ from Cape San Blas, Florida (85°30' W. Longitude), to the Texas/Mexico border and provided for the certification of the Fisheye BRD in the 30 mesh position. The purpose of this action was to reduce the bycatch mortality of juvenile red snapper by 44 percent from the average mortality for the years 1984-89. This amendment exempted shrimp trawls fishing for royal red shrimp outside of 100 fathoms, as well as groundfish and butterfish trawls. It also excluded small try nets and no more than two rigid frame roller trawls that do not exceed 16 feet. Amendment 9 also provided mechanisms to change the bycatch reduction criterion and to certify additional BRDs.

The Generic Amendment to Address Essential Fish Habitat (EFH) Requirements of the Fishery Management Plans of the Gulf of Mexico was approved by NMFS on February 8, 1999. NMFS approved identification of EFH for 26 species discussed in the amendment and the coral complex, but did not approve using those descriptions as proxies for all remaining species under management. NMFS approved the discussion of impacts on EFH from the use of three types of fishing gears, but concluded that additional assessments for the remaining gear types should be considered in subsequent amendments as more information became available.

The Generic Sustainable Fisheries Act Amendment to the Gulf of Mexico Fishery Management Plans was partially approved by NMFS on November 17, 1999. NMFS approved the descriptions of the fisheries and fishing communities, construction changes to stone crab traps to reduce bycatch, and certain stock status criteria definitions. NMFS disapproved the portions dealing with bycatch reporting, bycatch reduction for fisheries other than stone crabs, and certain stock status criteria definitions.

Amendment 10 required the installation of NMFS-certified BRDs that reduce the bycatch of finfish by at least 30 percent by weight in each net used aboard vessels trawling for shrimp in the Gulf of Mexico EEZ east of Cape San Blas, Florida (85° 30" W. Longitude). Vessels trawling for groundfish or butterfish were exempted. A single try net with a headrope length of 16 feet or less per vessel and no more than two rigid-frame roller trawls limited to 16 feet or less, such as those used in the Big Bend area of Florida were also exempted. Amendment 10 also established bycatch reporting requirements for the shrimp fishery throughout the Gulf of Mexico.

Amendment 11, implemented December 5, 2002, required all vessels harvesting shrimp from the EEZ to obtain a commercial shrimp vessel permit from NMFS; prohibited the use of traps to harvest royal red shrimp from the EEZ; and prohibited the transfer or royal red shrimp at sea.

Amendment 12, implemented August 19, 2002, established two marine reserves in the EEZ in the vicinity of the Dry Tortugas, Florida known as Tortugas North and Tortugas South, in which fishing for any species and bottom anchoring by fishing vessels is prohibited. This action complemented previous actions taken under the National Marine Sanctuaries Act.

Amendment 13: (1) established an endorsement to the existing federal shrimp vessel permit for vessels harvesting royal red shrimp; (2) defined MSY, optimum yield (OY), the overfishing threshold, and the overfished condition for royal red and penaeid shrimp stocks in the Gulf for stocks that currently lack such definitions; (3) established bycatch reporting methodologies and improve collection of shrimping effort data in the exclusive economic zone; (4) required completion of a Gulf Shrimp Vessel and Gear Characterization Form; (5) established a moratorium on the issuance of commercial shrimp vessel permits; and (6) required reporting and certification of landings during a moratorium.

Amendment 14, part of Joint Reef Fish Amendment 27/Shrimp Amendment 14 was submitted to NMFS in June, 2007. It established a target reduction goal for juvenile red snapper mortality of 74 percent less than the benchmark years of 2001-2003, reducing that target goal to 67 percent beginning in 2011, and eventually reducing the target to 60 percent by 2032. If necessary, a seasonal closure in the shrimp fishery can be implemented in conjunction with the annual Texas closure. The need for a closure is determined by an annual evaluation by the NMFS Regional Administrator. The joint amendment also addressed overfishing and bycatch issues in both the red snapper directed fishery and the shrimp fishery.

2.3.2 History of Management Plans and Amendments of U.S. South Atlantic Area Shrimp Fishery

The fishery for shrimp in the U.S. Southeast Atlantic EEZ is managed under the FMP for the Shrimp Fishery of the South Atlantic Region. The FMP was prepared by the South Atlantic Fishery Management Council (South Atlantic Council or SAFMC), approved by NMFS, and implemented under the authority of the MSA by regulations at 50 CFR part 622.

The SAFMC prepared an FMP with an EIS for the shrimp fishery of the South Atlantic region. Approved in December 1993, the principle actions included white shrimp in the management unit (brown, pink, royal red, and rock shrimp were recognized but not included in the management unit), established stock status criteria (optimum yield [OY] and overfishing) for white shrimp, and established options to close the EEZ adjacent to closed state waters to white shrimp fishing following severe cold weather (exempted from closures were fisheries for royal red and rock shrimp).

Amendment 1, (1996), added rock shrimp to the management unit, prohibited rock shrimp trawling in the Oculina Bank Habitat Area of Particular Concern, and required federal vessel permits for the rock shrimp fishery.

Amendment 2 (1997), with a Supplemental Final EIS, added brown and pink shrimp to the management unit, described overfishing thresholds and OY targets, required the use of certified BRDs in shrimp trawls fished in the EEZ, and established a BRD certification process.

Amendment 3 (1998), with a Supplemental EIS, addressed EFH requirements for the species in the management unit.

Amendment 4 (1998), with an Environmental Assessment, addressed Sustainable Fishery Act requirements of the MSA, including establishment of stock status thresholds and targets (MSY, OY) as well as rebuilding requirements and bycatch reporting requirements.

Amendment 5 (2003) addressed requirements for the rock shrimp fishery. The amendment established a limited access program requiring limited access endorsements for owners of vessels who qualified, operator permits, and a minimum mesh size for the codend of a rock shrimp trawl in the EEZ off Florida and Georgia of 1 ⅞ inches to allow the escapement of juvenile shrimp. It also required the use of Vessel Monitoring Systems (VMS) for vessels operating in the South Atlantic to protect increase enforcement capability and protect habitat, especially the Oculina Bank Habitat Area of Special Concern off of the East Coast of Florida that is closed to trawling.

Amendment 6 (2005) established a federal permit for the penaeid (pink, white, and brown) shrimp, required BRD's in the rock shrimp fishery, amended the BRD Testing Protocol and criteria for certification, established a method to monitor and assess bycatch in the rock shrimp and penaeid shrimp fishery, and addressed stock status determination criteria.

Amendment 7 (2009) addressed the current landing requirement for rock shrimp limited access endorsements, reinstated endorsements lost due either to not meeting the landing requirement in one of four consecutive calendar years or not renewing the endorsement on time, renamed the permit/endorsement system to minimize confusion; required verification of VMS to renew, reinstate or transfer a limited access endorsement; and required provision of economic data by federal shrimp permit holders

2.4 Management of State Shrimp Fisheries, Subject to the Sea Turtle Conservation Regulations

A major amount of shrimping occurs in state waters of the Gulf and South Atlantic areas, and therefore, is not under the management of the GMFMC, SAFMC, or NMFS.

The states require permits or licenses for trawlers operating in state waters or landing shrimp in the state. All states but North Carolina restrict the number and/or the size of nets that may be used in inshore state waters. In Georgia and South Carolina, inshore waters are for the most part closed to commercial trawlers. Many states also restrict the number and/or the size of nets that may be used in offshore state waters as a way to limit overall effort (Georgia, South Carolina, Louisiana, Texas [out to 3 nautical miles], and Florida [out to 3 nautical miles in the Gulf, 1 nautical mile in the Atlantic]). Most states manage their shrimp stocks with minimum mesh size requirements for trawls and with closed seasons to protect spawning shrimp or to allow juvenile shrimp to mature to more valuable sizes. Some states (Texas, Florida, Georgia, South Carolina, and North Carolina) require shrimp trawlers to use TEDs, with regulations that either mirror or are more restrictive than the Federal requirements, and some states (Texas, Florida, Georgia, North Carolina and South Carolina) also require the use of BRDs in state waters. Georgia, South Carolina, and Florida (partially) restrict shrimp trawling to daytime hours only in state waters.

2.5 Shrimp Fishing Effort Since 2001

Our 2002 opinion analysis was based on 2001 otter trawl effort levels and the expectation that otter trawl effort would remain at that level in the future. However, since that time, there has been a dramatic decrease in otter trawl effort in southeast U.S. shrimp fisheries which has been attributed to low shrimp prices, rising fuel costs, competition with imported products, and the impacts of 2005 and 2006 hurricanes in the Gulf of Mexico (Table 1 and Figure 4).

Overall shrimp otter trawl effort since 2001 has been radically reduced. In the Gulf of Mexico, otter trawl effort effort steadily declined at a rapid rate from mid-2002 through 2005, with an overall otter trawl effort reduction of 53 percent during that time frame. Otter trawl ffort then continued to decline through the first half of 2008, but at a slower rate. Otter trawl effort increased slightly from the second half of 2008 through 2009, perhaps as some vessels damaged or destroyed during the 2005/2006 hurricanes were repaired or replaced, but effort was still 61 percent less than it was in 2001. Given that shrimp otter trawl fisheries still faces many of the other challenges that contributed to effort declines and that 2010 effort was lower than 2009 (J. Nance, SEFSC, pers. comm.), otter trawl effort is not expected to increase substantially in the near future.

Otter trawl effort in the South Atlantic has also declined since 2001. Between 2002 and 2005 otter trawl effort declined steadily. It rose from 2005 through 2006 to near 2004 levels, but has declined steadily since then, albeit minimally. Overall otter trawl effort reduction in the South Atlantic between 2002 and 2009 was approximately 38 percent. There is no data to indicate that otter trawl effort levels will increase in the future from recent levels.

Table 1. 2001-2009 Shrimp Trawl Effort

Year	Gulf of Mexico	South Atlantic
	#Days Fished	# Trips
2001	277,888	21,780
2002	276,059	25,320
2003	224,597	21,247
2004	189,241	17,813
2005	131,650	13,305
2006	116,710	16,860
2007	107,671	14,495
2008	87,952	13,763
2009	108,501	13,464

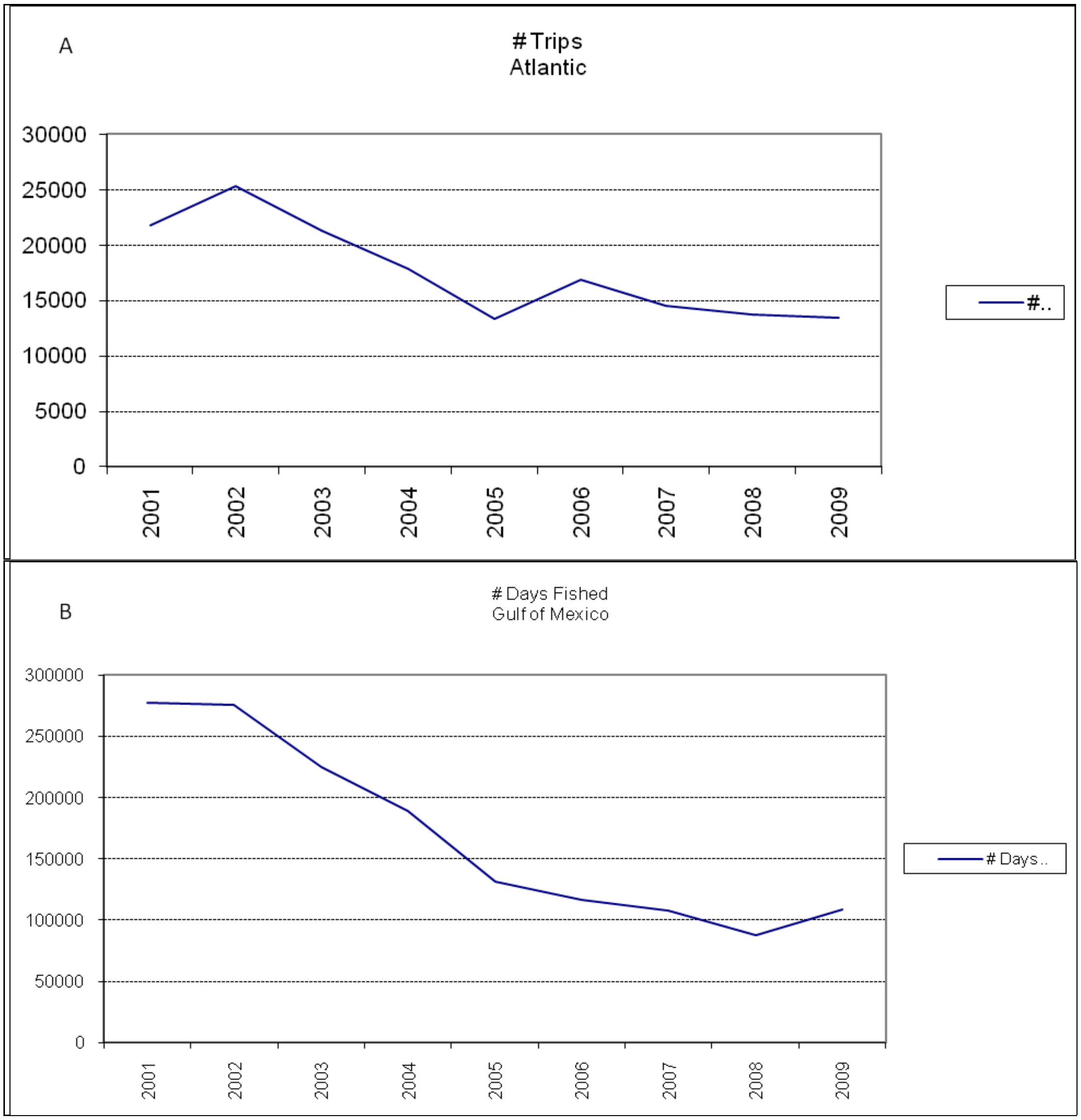

Figure 4. 2001-2009 Shrimp Trawling Effort in the Atlantic (A) and Gulf (B)

Likewise, the skimmer trawl fisheries have witnessed similar declines. License sales for skimmer trawls and wing nets in Louisiana have declined from a 5-year average of 10,108 licenses during the period of 2000-2004, to a 5-year average of 6,669 licenses during 2006-2010. Likewise, landings of shrimp from skimmer trawl and wing net vessels have also declined on average, from 52.2 million pounds during 2000-2004, to 47.7 million pounds during 2006-2010. Similar declines are expected for other states that host skimmer trawl fleets. For instance, active skimmer vessels in North Carolina have declined from 99 vessels in 2006 to 64 vessels in 2010. These declines are largely a result of rising fuel costs, increased competition from foreign imports that deflate domestic shrimp prices, and the impacts of numerous hurricanes during 2004 and 2005. Given the prospect that fuel prices will not significantly decrease on average, as well as information in Miller et al. (2011) indicating Gulf of Mexico inshore shrimpers are already operating at a loss, and we expect average overall participation and effort in the skimmer trawl fisheries will continue to decrease in future years.

2.6 Action Area

NMFS' sea turtle conservation regulations under the ESA apply to all shrimp trawlers, wherever they occur. They apply in federal waters (i.e., the Gulf and South Atlantic EEZ), where NMFS authorizes shrimp trawling via two federal fishery management plans under the MSA, and in state waters, where fisheries are authorized by respective state agencies. Unlike NMFS' authority to manage fisheries under the Magnuson Stevens Act, NMFS' authority to conserve listed species under the ESA is not restricted to federal waters. Section 4 (d) of the ESA allows NMFS to issue regulations for threatened species as deemed necessary and advisable for the conservation of such species. Section 11(f) of the ESA allows NMFS to promulgate such regulations as may be appropriate to enforce the ESA. Thus, although NMFS does not authorize state fisheries, NMFS, in implementing the sea turtle conservation regulations, does mandate that those state-authorized fisheries comply with the sea turtle conservation regulations (which require most shrimp trawlers to use TEDs or tow-time restrictions) and provides an exemption from the section 9 take prohibitions that would otherwise apply to sea turtle species. Therefore, the action area for this consultation includes the Gulf and South Atlantic EEZ and adjacent marine and tidal state waters of the Gulf and South Atlantic area (i.e., from the Texas-Mexico border to the North Carolina-Virginia border). The Gulf EEZ 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, out to 200 nautical miles from the baseline from which the territorial sea of the United States is measured. The South Atlantic EEZ extends from 3 nautical miles seaward of the states of North Carolina, South Carolina, Georgia, and Florida, out to 200 nautical miles from the baseline from which the territorial sea of the United States is measured. Specific fishing areas within the action area are determined by a variety of biological (e.g., distribution of shrimp), socio-economical (e.g., market factors, location of ports, operating costs), and regulatory factors (e.g., gear-restricted areas and closed areas).

3.0 Status of Species and Critical Habitat

Listed species occurring within the action area that may be affected by the proposed action include six species of whales, five species of sea turtles, four species of fish, two invertebrate species, and one plant. Table 2 lists each species, scientific name and status, as well as the specific geographic area within the action area in which each species occurs. Designated critical habitat in the action area is listed in Table 3.

Table 2. Status of Listed Species in the Action Area (E= Endangered, T=Threatened)

Species		Scientific Name	Status	Geographic Area
Whales	Sei whale	*Balaenoptera borealis*	E	South Atlantic
	Blue whale	*Balaenoptera musculus*	E	South Atlantic, EEZ only
	Fin whale	*Balaenoptera physalus*	E	South Atlantic
	North Atlantic right whale	*Eubalaena glacialis*	E	South Atlantic
	Sperm whale	*Physeter macrocephalus*	E	South Atlantic and Gulf, EEZ only
	Humpback whale	*Megaptera novaeangliae*	E	South Atlantic
Sea Turtles	Loggerhead sea turtle, Northwest Atlantic (NWA) DPS	*Caretta caretta*	T	South Atlantic and Gulf
	Green sea turtle	*Chelonia mydas*	E/T[2]	South Atlantic and Gulf
	Leatherback sea turtle	Dermochelys coriacea	E	South Atlantic and Gulf
	Hawksbill sea turtle	*Eretmochelys imbricata*	E	South Atlantic and Gulf
	Kemp's ridley sea turtle	*Lepidochelys kempii*	E	South Atlantic and Gulf
Fish	Shortnose sturgeon	*Acipenser brevirostrum*	E	South Atlantic, within state waters only
	Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	E	South Atlantic
	Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	Gulf
	Smalltooth sawfish	*Pristis pectinata*	E	South Atlantic and Gulf
Invertebrates	*Staghorn coral*	*Acropora cervicornis*	T	South Atlantic and Gulf
	Elkhorn coral	*Acropora palmata*	T	South Atlantic and Gulf
Plants	*Johnson Sea Grass*	*Halophila johnsonii*	T	South Atlantic, within state waters only

[2] Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered.

Table 3. Critical Habitats in the Action Area

Critical Habitat For:	Species	Geographic Area
	North Atlantic right whale	South Atlantic
	Gulf Sturgeon	Gulf , within state waters only
	Smalltooth Sawfish	South Atlantic, within shallow state waters only
	Elkhorn and staghorn coral	South Atlantic

3.1 Analysis of Species and Critical Habitats Not Likely to be Adversely Affected

After reviewing the proposed action, we believe the proper scope of the effect analysis for this opinion is: (1) the effect that NMFS' exemption of the take of sea turtles through its sea turtle conservation regulations has on listed species, (2) the effect that the sea turtle conservation regulations themselves have on listed species, and (3) the effect that federally-authorized shrimp fisheries (also subject to the sea turtle conservation regulations) have on listed species. Since the purpose of the sea turtle conservation regulations is to conserve all sea turtles (in both state and federal waters) and the TED regulations provide an exemption to state water shrimp trawl fishermen to incidentally capture sea turtles, we evaluate the regulations' sufficiency through this opinion and the jeopardy standard. We also look at how the sea turtle conservations regulations may affect other species via its TED requirements and tow time restrictions. NMFS has not promulgated any section 4(d) rules applicable to the shrimp fisheries that exempt the take of any other species beside sea turtles. Therefore, NMFS does not bear responsibility for the take of these other listed species in state-managed fisheries and does not authorize that take via the ITS. Last, we evaluate the effects of our authorizing of federal shrimp fisheries via our two FMPs, where we are solely responsible for all of the effects on listed species.

We have determined that the proposed action is not likely to adversely affect any listed whales (i.e., blue, sei, sperm, fin, humpack, or North Atlantic right whales), shortnose sturgeon, or corals and would have no effect on Johnson seagrass. We have also determined that the proposed action is not likely to adversely affect the designated critical habitats for Gulf sturgeon and elkhorn and staghorn corals and will have no effect on North Atlantic right whale, smalltooth sawfish, and Johnson's seagrass critical habitat. These species and designated critical habitats are excluded from further analysis and consideration in this opinion. The following discussion summarizes our rationale for these determinations.

Whales

All six species of listed large whales protected by the ESA can be found in or near the Atlantic portion of the action area. In the Gulf of Mexico portion of the action area, sperm whales are the only endemic populations of whales. Blue, fin, sei, and sperm whales are predominantly found seaward of the continental shelf in waters where most shrimping does not occur. Sightings of sperm whales are almost exclusively in the continental shelf edge and continental slope areas (Scott and Sadove 1997). Sei and blue whales also typically occur in deeper waters and neither is commonly observed in the waters of the Gulf of Mexico or off the U.S. East Coast (CETAP 1982; Wenzel et al. 1988; Waring et al. 2002; Waring et al. 2006). Fin whales are generally found along the 100-m isobath with sightings also spread over deeper water including canyons along the shelf break (Waring et al. 2006). North Atlantic right whales and humpback whales are coastal animals and sighted in the nearshore environment in the Atlantic along the southeastern United States from November through March. North Atlantic right and humpback whales have also been spotted in the Gulf of Mexico, but only very rarely, and these sightings are thought to be inexperienced juveniles.

The potential route of effect from the proposed action on whales is via vessel collisions with NMFS-authorized trawls fishing in federal waters or entanglement in their nets. There have been no reported interactions between offshore or coastal large whales and trawls in the Atlantic or Gulf of Mexico (76 FR 73912). In the rare event that a listed whale is in the same vicinity of a shrimp trawl, shrimp trawlers move slowly (e.g., average 2007-2010 observed shrimp vessel speed for all areas and fisheries [GOM penaeid, SA penaeid, SA rock shrimp] was 2.8 km., E. Scott-Denton, SEFSC, pers. comm.). This would give a whale or the fishing vessel time to avoid a collision or entanglement. Based on this information, the chance of the proposed action affecting any large whales protected by the ESA is discountable.

North Atlantic Right Whale Critical Habitat

Designated north Atlantic right whale critical habitat (50 FR 28793) can be found in the Atlantic portion of the action area from the mouth of the Altamaha River, Georgia, to Jacksonville, Florida, out 15 nautical miles (nm) and from Jacksonville, Florida, to Sebastian Inlet, Florida, out 5 nm. However, the proposed action will have no effect on the physical and biological features [water depth, water temperature, and the distribution of right whale cow/calf pairs in relation to the distance from the shoreline to the 40-m isobath (Kraus et al. 1993)], which were the basis for determining this habitat to be critical.

Shortnose sturgeon

Shortnose sturgeon can be found in a number of river systems near the Atlantic portion of the action area. The shortnose sturgeon is considered a freshwater amphidromous species in the northeastern USA, rather than an anadromous one (Kieffer and Kynard 1993). Although it may exhibit a slightly greater tendency to use saline habitats in the southern portion of its range, the shortnose sturgeon rarely occurs in coastal waters where the shrimp trawl fisheries are pursued (Collins et al. 1996). The chance of a shortnose sturgeon entering federal waters and being captured during NMFS-authorized shrimp trawling is extremely unlikely and discountable. It is possible that there is a very small amount of overlap between state-managed trawl fisheries during winter months. However, in the rare event a shortnose sturgeon interacts with a shrimp trawl in state waters, NMFS's implementation of the sea turtle conservation regulations may benefit shortnose sturgeon by requiring the use of TEDs in the shrimp trawls and providing a route of escape and thus increasing its survival likelihood. During TED testing conducted by the NMFS Southeast Fisheries Science Center, TEDs were estimated to exclude 87% of encountered sturgeon (i.e., Atlantic and Gulf sturgeon) from capture by trawl nets. Given both Gulf and Atlantic sturgeon use TEDs to escape capture in trawl nets, presumably shortnose sturgeon would also be able to. The exemption of sea turtle take via the sea turtle conservation regulations is expected to have no affect on shortnose sturgeon. Therefore, NMFS' implementation of the sea turtle conservation regulations and the exemption of sea turtle take through those actions would either have no effect or a solely beneficial effect on how state-authorized trawling affects shortnose sturgeon.

Johnson’s Seagrass
Johnson’s seagrass grows only along approximately 200 kilometers (km) of coastline in southeastern Florida north of Sebastian Inlet, Indian River County, south to Virginia Key in northern Biscayne Bay, Miami-Dade County. Within that area, Johnson seagrass occurs in a patchy, disjunct distribution from the intertidal zone to depths of approximately 2-3 meters in a wide range of sediment types, salinities, and in variable water quality conditions (NMFS 2007). Thus, there is no overlap between Johnson seagrass and NMFS-authorized trawl fisheries. It is possible that there is a very small amount of overlap between state-managed trawl fisheries, but NMFS’ implementation of the sea turtle conservation regulations and the exemption of sea turtle take through those actions would have no effect on how state-authorized trawling may affect Johnson seagrass. Potential effects to Johnson seagrass from state-authorized trawling stem from trawls being dragged over them and potentially uprooting them whereas the proposed sea turtle conservation regulations are aimed at providing a way for mobile animals to escape from inside shrimp trawl nets.

Johnson’s Seagrass Critical Habitat
Johnson’s seagrass critical habitat is designated to include substrate and water in the following ten portions of the Indian River Lagoon and Biscayne Bay, Florida, within the current range of Johnson's seagrass (See 50 CFR 226.213 for geographic coordinates):

(a) North of Sebastian Inlet Channel.
(b) South of Sebastian Inlet Channel.
(c) Fort Pierce Inlet.
(d) North of St. Lucie Inlet.
(e) Hobe Sound.
(f) South side of Jupiter Inlet.
(g) A portion of Lake Worth Lagoon north of Bingham Island.
(h) A portion of Lake Worth Lagoon, located just north of the Boynton Inlet.
(i) A portion of northeast Lake Wyman, Boca Raton.
(j) A portion of Northern Biscayne Bay.

The essential features of Johnson seagrass critical habitat are: (1) adequate water quality; (2) adequate salinity levels; (3) adequate water transparency; and (4) stable, unconsolidated sediments that are free from physical disturbance.

Johnson seagrass critical habitat areas are all contained within shallow state waters where the proposed action is limited to implementation of the sea turtle conservation regulations and the exemption of sea turtle take through those actions. These actions would have no effect on the physical and biological features identified as essential for Johnson’s seagrass. Again, the proposed sea turtle conservation regulations are aimed at providing a way for mobile animals to escape from inside shrimp trawl nets and do not change how trawls interact with the sea floor.

Gulf Sturgeon Critical Habitat
Gulf sturgeon critical habitat was jointly designated by NMFS and USFWS on April 18, 2003 (50 CFR 226.214). Fourteen areas (units) are designated as Gulf sturgeon critical habitats; of which seven occur in the action area: Unit 8 (Lake Pontchartrain [east of causeway], Lake

Catherine, Little Lake, the Rigolets, Lake Borgne, Pascagoula Bay, and Mississippi Sound systems in Louisiana and Mississippi, and sections of the state waters within the Gulf of Mexico); Unit 9 (Pensacola Bay system in Florida); Unit 10 (Santa Rosa Sound in Florida); Unit 11 (Nearshore Gulf of Mexico in Florida); Unit 12 (Choctawhatchee Bay system in Florida); Unit 13 (Apalachicola Bay system in Gulf and Franklin Counties, Florida); and Unit 14 (Suwannee Sound in Florida). The physical and biological features identified as essential for the conservation of the Gulf sturgeon within these waters are abundant prey items; water and sediment quality necessary for normal behavior, growth, and viability of all life stages; and, safe unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats.

The proposed action is not likely to adversely affect Gulf sturgeon critical habitat. The critical habitat units above are all contained within state waters where the proposed action is limited to implementation of the sea turtle conservation regulations and the exemption of sea turtle take. These proposed actions have no effect on the Gulf sturgeon essential features relating to prey items and water and sediment quality (i.e., they do not change the abundance of prey items or water and sediment quality). The TED requirement is expected to be solely beneficial by maintaining unobstructed migratory pathways via providing a mechanism for Gulf sturgeon to escape and continue on their path in the event that they are swept up by a shrimp vessel in state waters fishing under the authority of that state.

Elkhorn and Staghorn Coral

The proposed action is not likely to adversely affect listed corals. The potential route of effect from the proposed action on *Acropora* is via physical damage from NMFS-authorized trawling in federal waters. However, adverse effects from the fishery on *Acropora* are extremely unlikely to occur and are discountable given differences between shrimp and *Acropora* preferred habitats, and protective regulations in place prohibiting or limiting trawling in areas where *Acropora* are most likely to occur. White shrimp appear to prefer muddy or peaty bottoms when in inshore waters and soft muddy bottoms when offshore. Brown shrimp appear to prefer a similar bottom type and may also be found in areas of unconsolidated sediment (i.e., mud, sand, and shell). Pink shrimp are found most commonly on unconsolidated sediment.[3] Royal red and rock shrimp are targeted in waters 130 ft to 200-300 feet off the eastern Florida coast. Royal red shrimp occur only in the very deep waters of the South Atlantic and Gulf of Mexico EEZ (130 to 300 fathoms). Acroporoid corals are found in waters less than 30m and are considered to be environmentally sensitive, requiring relatively clear, well circulated waters with optimal water temperatures of 25-29°C; these shrimp habitats are extremely unlikely to support *Acropora* species. Within the action area, elkhorn and staghorn coral may both occur near the Florida Keys and off the east coast of Florida in waters less than 30 m. The maximum northern extent of elkhorn and staghorn coral is off Broward County and Palm Beach County, respectively. Only approximately 645 km2 (249 mi2) of Gulf of Mexico EEZ waters around the Florida Keys are within the potential depth range of these species. A single colony of elkhorn coral has been observed in the Flower Garden Banks in the northwestern Gulf of Mexico. Protective regulations are in place prohibiting or limiting trawling in these areas (i.e., East and West Flower

[3] Final Amendment 2 (Bycatch Reduction) to the Fishery Management Plan for the Shrimp Fishery of the South Atlantic Region. 1996. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699.

Garden Banks, Tortugas Shrimp Sanctuary). In the South Atlantic off Florida, regulations at 15 CFR section 922.163 prohibit the discharge of fishing/marine debris into the water of the Florida Keys National Marine Sanctuary. Regulations at 15 CFR section 922.164 provide additional protection for corals (including *Acropora* species) occurring within existing management areas. Most applicable is that the use of bottom trawls and other bottom tending gears is prohibited.

Elkhorn and Staghorn Coral Critical Habitat
The proposed action is not likely to adversely affect *Acropora* critical habitat. The potential route of effect from the proposed action on *Acropora* designated critical habitat is physical damage from NMFS-authorized trawling in federal waters. Areas of critical habitat occurring in the action area are limited to a small portion of the South Atlantic. The feature essential to the conservation of *Acropora* species is substrate of suitable quality and availability (i.e., "natural consolidated hard substrate or dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover"), in water depths from the mean high water line to 30 m. Because of the habitat types of commercially exploited shrimp species (see above description), fishing targeting these species is unlikely to occur to on hard substrate of suitable quality and availability. Thus, adverse affects from the fishery on *Acropora* critical habitat are extremely unlikely to occur and are discountable.

Smalltooth Sawfish Critical Habitat
On September 2, 2009, NMFS issued a final rule (74 FR 45353; see also, 50 CFR § 226.218) to designate critical habitat for the U.S. DPS of smalltooth sawfish. The critical habitat consists of two units: the Charlotte Harbor Estuary Unit (CHEU), which comprises approximately 221,459 acres (346 mi2) of coastal habitat, and the Ten Thousand Islands/Everglades Unit, which comprises approximately 619,013 acres (967 mi2) of coastal habitat in southwest Florida.

The critical habitat units are both contained within state waters. The key conservation objective for the critical habitat units is to facilitate recruitment into the adult population by protecting juvenile nursery areas. The essential features of smalltooth sawfish critical habitat are: (1) red mangroves; and (2) shallow, euryhaline (fluctuating salinity) habitats, characterized by water depths between mean high water (MHW) and 3 feet measured at mean lower low waterline (MLLW).

Designated critical habitat for the U.S. DPS of smalltooth sawfish is contained within the shallow waters where the proposed action is limited to implementation of sea turtle conservation regulations and the exemption of sea turtle take through those actions. These actions will have no effect on the essential features identified in the critical habitat designation for the U.S. DPS of smalltooth sawfish.

3.2 Analysis of Species Likely to be Adversely Affected

Green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles, Atlantic and Gulf sturgeon, 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, travel widely throughout the Gulf and South Atlantic, and are known to occur in areas subject to shrimp trawling. The distribution of Atlantic sturgeon, Gulf sturgeon, and smalltooth sawfish within the action area is more limited, but all of these species do overlap in certain regions of the action area and all of these species have been documented as incidentally captured in shrimp trawls. The remaining sections of this opinion will focus solely on these species.

The following subsections are synopses of the best available information on the status of the species that are likely to be adversely affected by one or more components of the proposed action, including information on the distribution, population structure, life history, abundance, and population trends of each species and threats to each species. The biology and ecology of these species as well as their status and trends inform the effects analysis for this opinion. 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 1991), hawksbill sea turtle (NMFS and USFWS 1993), Kemp's ridley sea turtle (NMFS and USFWS 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; NMFS and USFWS 1998b; NMFS and USFWS 1998c; NMFS and USFWS 1998d); and sea turtle status reviews, stock assessments, and biological reports (NMFS and USFWS 1995; TEWG 1998; TEWG 2000; NMFS-SEFSC 2001; TEWG 2007; NMFS and USFWS 2007a; NMFS and USFWS 2007b; NMFS and USFWS 2007c; NMFS and USFWS 2007d; NMFS and USFWS 2007e; Conant et al. 2009; TEWG 2009; NMFS-SEFSC 2009d). 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; Poulakis and Seitz 2004; Simpfendorfer and Wiley 2004; Simpfendorfer and Wiley 2005)]. Sources of background information on Atlantic sturgeon include the status review (ASSRT and NMFS 2007) and proposed and final listing rules (77 FR 5880 and 77 FR 5914). Gulf sturgeon background documents include the final listing rule (56 CFR 49653), recovery plan (NMFS and USFWS 1995), and 5-year status review (USFWS and NMFS 2009).

3.2.1 Loggerhead Sea Turtle – NW Atlantic DPS

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. NMFS and USFWS published a final rule designating nine DPSs for loggerhead sea turtles (76 FR 58868, September 22, 2011; effective October 24, 2011). The DPSs established by this rule include: (1) Northwest Atlantic Ocean (threatened); (2) Northeast Atlantic Ocean (endangered); (3) South Atlantic Ocean (threatened); (4) Mediterranean Sea (endangered); (5) North Pacific Ocean (endangered); (6) South Pacific Ocean (endangered); (7) North Indian Ocean (endangered); (8) Southeast Indo-Pacific Ocean (endangered); and (9) Southwest Indian Ocean (threatened). The Northwest Atlantic DPS (NWA DPS) is the only one that occurs within the action area and therefore is the only one to be considered in this opinion. No critical habitat has been designated as of the time of this opinion.

Species Description, Distribution, and Population Structure
Loggerheads are large sea turtles with the mean straight carapace length (SCL) of adults in the southeast U.S. being approximately 92 cm. The corresponding mass is approximately 116 kg (Ehrhart and Yoder 1978). Adult and subadult loggerhead sea turtles typically have a light yellow plastron and a reddish brown carapace covered by non-overlapping scutes that meet along

seam lines. They typically have 11 or 12 pairs of marginal scutes, five pairs of costals, five vertebrals, and a nuchal (precentral) scute that is in contact with the first pair of costal scutes (Dodd 1988).

The loggerhead sea turtle inhabits continental shelf and estuarine environments and occurs throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd 1988). The majority of loggerhead nesting occurs at the western rims of the Atlantic and Indian Oceans concentrated in the north and south temperate zones and subtropics (NRC 1990).

In the western North Atlantic, the majority of loggerhead nesting is concentrated along the coasts of the United States from southern Virginia to Alabama. Additional nesting beaches are found along the northern and western Gulf of Mexico, eastern Yucatán Peninsula, at Cay Sal Bank in the eastern Bahamas (Addison and Morford 1996; Addison 1997), off the southwestern coast of Cuba (Gavilan 2001), and along the coasts of Central America, Colombia, Venezuela, and the eastern Caribbean Islands.

Non-nesting, adult female loggerheads are reported throughout the U.S. and Caribbean Sea. Little is known about the distribution of adult males who are seasonally abundant near nesting beaches although aerial surveys suggest that loggerheads in U.S. waters are distributed as a whole in the following proportions: 54 percent in the southeast U.S. Atlantic, 29 percent in the northeast U.S. Atlantic, 12 percent in the eastern Gulf of Mexico, and 5 percent in the western Gulf of Mexico (TEWG 1998). Shallow water habitats with large expanses of open ocean access, such as Florida Bay, provide year-round resident foraging areas for significant numbers of male and female adult loggerheads while juveniles are also found in enclosed, shallow water estuarine environments not frequented by adults (Epperly et al. 1995c). Further offshore, adults primarily inhabit continental shelf waters, from New England south to Florida, the Caribbean, and Gulf of Mexico (Schroeder et al. 2003). Benthic, immature loggerheads foraging in northeastern U.S. waters are known to migrate southward in the fall as water temperatures cool and then migrate back northward in spring (Shoop and Kenney 1992; Keinath 1993; Epperly et al. 1995c; Morreale and Standora 1998).

Within the NWA DPS, 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 29°N 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 M 1990; 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 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. Although the recovery plan was written prior to the listing of the NWA DPS, the recovery units for what was then termed the Northwest Atlantic population apply to the NWA DPS.

Life History Information
Loggerhead sea turtles reach sexual maturity between 20 and 38 years of age, although this varies widely among populations (Frazer and Ehrhart 1985; NMFS and SEFSC 2001). The annual mating season for loggerhead sea turtles occurs from late March to early June, and eggs are laid throughout the summer months. Female loggerheads deposit an average of 4.1 nests within a nesting season (Murphy and Hopkins 1984) and have an average remigration interval of 3.7 years (Tucker 2010). Mean clutch size varies from 100 to 126 eggs for nests occurring along the southeastern U.S. coast (Dodd 1988).

Loggerheads originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for a period as long as 7-12 years (Bolten et al. 1998). Stranding records indicate that when immature loggerheads reach 40-60 centimeters straight carapace length, they begin to occur in coastal inshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico (Witzell 2002). Recent studies have suggested that not all loggerhead sea turtles follow the model of circumnavigating the North Atlantic Gyre as pelagic juveniles, followed by permanent settlement into benthic environments (Laurent et al. 1998; Bolten and Witherington 2003). These studies suggest some turtles may either remain in the pelagic habitat in the North Atlantic longer than hypothesized or move back and forth between pelagic and coastal habitats interchangeably (Witzell 2002).

As post-hatchlings, loggerheads hatched on U.S. beaches migrate offshore and become associated with Sargassum habitats, driftlines, and other convergence zones (Carr 1986) (Witherington 2002). 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 found in coastal waters and prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

Abundance and Trends
A number of stock assessments and similar reviews (TEWG 1998; TEWG 2000; NMFS and SEFSC 2001; Heppell et al. 2003; NMFS and USFWS 2008; Conant et al. 2009; TEWG 2009; NMFS-SEFSC 2009d) 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)]. 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. Analysis of available data for the Peninsular Florida Recovery Unit up through 2008 led to the conclusion that the observed decline in nesting for that unit could 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 the Northern Recovery Unit (NRU) averaged 5,215 nests from 1989-2008, a period of near-complete surveys of NRU nesting beaches (Georgia Department of Natural Resources (GDNR) unpublished data, North Carolina Wildlife Resources Commission unpublished data, South Carolina Department of Natural Resources (SCDNR) unpublished data), and represent 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 from 1980 through 2008. Overall, there is strong statistical data to suggest the NRU has experienced a long-term decline. Data in 2008 showed improved nesting numbers. In 2008, 841 loggerhead nests were observed compared to the 10-year average of 715 nests in North Carolina. The number dropped to 276 in 2009, but rose again in 2010 (846 nests) and 2011 (948 nests). 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. Nesting dropped in 2009 to 2,183, with an increase to 3,141 in 2010. 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. In 2009, the number of nests declined to 998, and in 2010, a new statewide record was established with 1,760 loggerhead nests. (GDNR, NCWRC, and SCDNR nesting data located at www.seaturtle.org).

Another consideration that may add to the importance and vulnerability of the NMU is the sex ratio of this subpopulation and its potential importance for genetic diversity. Research conducted over a limited timeframe but across multiple years found that while the small Northern subpopulation can produce a larger proportion of male hatchlings than the large Peninsular Florida subpopulation, the sex ratio is female biased. In most years, the extent of the female bias is likely to be less extreme based upon current information. However, because their absolute numbers are small, their contribution to overall hatchling sex ratios is small (Wyneken et al. 2004; Wyneken et al. 2012). 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. 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 (all beaches including index nesting beaches) undertaken from 1989 to 2007 showed a mean of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (NMFS and USFWS 2008). The statewide estimated total for 2010 was 73,702 (FWRI nesting database). An analysis of index nesting beach data shows a 26 percent decline in nesting by the PFRU between 1989 and 2008, and a mean annual rate of decline of 1.6 percent despite a large increase in nesting for 2008, to 38,643 nests (NMFS and USFWS 2008; Witherington et al. 2009), FWRI nesting database). In 2009, nesting levels, while still higher than the lows of 2004, 2006, and 2007, dropped below 2008 levels to approximately 32,717 nests, but in 2010 a large increase was seen, with 47,880 nests on the index nesting beaches (FWRI nesting database). The 2010 Florida index nesting number is the largest since 2000. With the addition of data through 2010, the nesting trend for the proposed NWA DPS of loggerheads became only slightly negative and not statistically different from zero (no trend) (NMFS and USFWS 2010). Nesting at the index nesting beaches in 2011 declined from 2010, but was still the second highest since 2001, at 43,595 nests (FWRI nesting database).

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 species. Nesting surveys for the DTRU are conducted as part of Florida's statewide survey program. Survey effort was 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 (NMFS and USFWS 2008). Nest counts for the NGMRU are focused on index beaches rather than all beaches where nesting occurs. Analysis of 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). Nesting on the Florida Panhandle index beaches, which represents the majority of NGMRU nesting, had shown a large increase in 2008, but then declined again in 2009 and 2010 before rising back to a level similar to the 2003-2007 average in 2011. 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 long-term 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) 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 CPUEs 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 datasets 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 United States 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 (TEWG 2009). However, in-water studies throughout the eastern United States also indicate a substantial decrease in the abundance of the smallest Stage III loggerheads, a pattern also corroborated by stranding data (TEWG 2009).

The SEFSC has developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS-SEFSC 2009d). 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 model runs using those parameters. 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 most robust results from the model was an estimate of the adult female population size for the western North Atlantic in the 2004-2008 time frame. The distribution resulting from the model runs suggest the 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 (NMFS-SEFSC 2009d). A much less robust estimate for total benthic females in the western North Atlantic was also obtained, with a likely range of approximately 30,000-300,000 individuals, up to less than 1 million (NMFS-SEFSC 2009d).

Threats

Loggerhead sea turtles face numerous natural and anthropogenic threats that help shape its status and affect the ability of the species to recover. As many of the threats affecting loggerheads are either the same or similar in nature to threats affecting other listed sea turtle species, many of the threats identified in this section below are discussed in a general sense for all listed sea turtles rather than solely for loggerheads. Threats specific to a particular species are then discussed in the corresponding status sections where appropriate.

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). Domestic fishery operations often capture, injure, and kill sea turtles at various life stages. Loggerheads in the pelagic environment are exposed to U.S. Atlantic pelagic longline fisheries. Although loggerhead sea turtles are most vulnerable to pelagic longlines during their immature life history stage, there is some evidence that benthic juveniles may also be captured, injured, or killed by pelagic fisheries as well (Lewison et al.

2004). Southeast U.S. shrimp fisheries have historically been the largest fishery threat to benthic sea turtles in the southeastern U.S., and continue to interact with and kill large numbers of turtles each year. Loggerheads in the benthic environment in waters off the coastal United States are exposed to a suite of other fisheries in federal and state waters including trawl, gillnet, purse seine, hook-and-line, including bottom longline and vertical line (e.g., bandit gear, handline, and rod-reel), pound net, and trap fisheries (refer to the *Environmental Baseline* section of this opinion for more specific information regarding federal and state managed fisheries affecting sea turtles within the action area). In addition to domestic fisheries, sea turtles are subject to direct as well as incidental capture in numerous foreign fisheries, further exacerbating the ability of sea turtles to survive and recover on a global scale. For example, pelagic, immature loggerhead sea turtles circumnavigating the Atlantic are exposed to international longline fisheries including the Azorean, Spanish, and various other fleets (Bolten et al. 1994; Aguilar et al. 1995; Crouse 1999). Bottom set lines in the coastal waters of Madeira, Portugal, are reported to take an estimated 500 pelagic immature loggerheads each year (Dellinger and Encarnaçâo 2000) and gillnet fishing is known to occur in many foreign waters, including (but not limited to) the northwest Atlantic, western Mediterranean, South America, West Africa, Central America, and the Caribbean. Shrimp trawl fisheries are also occurring off the shores of numerous foreign countries and pose a significant threat to sea turtles similar to the impacts seen in U.S. waters. Many unreported takes or incomplete records by foreign fleets, making it difficult to characterize the total impact that international fishing pressure is having on listed sea turtles. Nevertheless, international fisheries represent a continuing threat to sea turtle survival and recovery throughout their respective ranges.

There are also many non-fishery impacts affecting the status of sea turtle species, both in the marine and terrestrial environment. In nearshore waters of the U.S., the construction and maintenance of Federal navigation channels has been identified as a source of sea turtle mortality. Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore borrow areas, move relatively rapidly and can entrain and kill sea turtles (NMFS 1997). Sea turtles entering coastal or inshore areas have been affected by entrainment in the cooling-water systems of electrical generating plants. Other nearshore threats include harassment and/or injury resulting from private and commercial vessel operations, military detonations and training exercises, and scientific research activities.

Coastal development can deter or interfere with nesting, affect nesting success, and degrade nesting habitats for sea turtles. Structural impacts to nesting habitat include the construction of buildings and pilings, beach armoring and renourishment, and sand extraction (Lutcavage et al. 1997; Bouchard et al. 1998). These factors may directly, through loss of beach habitat, or indirectly, through changing thermal profiles and increasing erosion, serve to decrease the amount of nesting area available to females and may change the natural behaviors of both adults and hatchlings (Ackerman 1997; Witherington et al. 2003; Witherington et al. 2007). In addition, coastal development is usually accompanied by artificial lighting which has been known to alter the behavior of nesting adults (Witherington 1992) and is often fatal to emerging hatchlings that are drawn away from the water (Witherington and Bjorndal 1991).

Predation by various land predators is a threat to developing nests and emerging hatchlings. Additionally, direct harvest of eggs and adults from beaches in foreign countries continues to be a problem for various sea turtle species throughout their ranges (NMFS and USFWS 2008).

Multiple municipal, industrial, and household sources, as well as atmospheric transport, introduce various pollutants such as pesticides, hydrocarbons, organochlorides (e.g. DDT and PCBs), and others that may cause adverse health effects to sea turtles (Iwata et al. 1993; Grant and Ross 2002; Garrett 2004; Hartwell 2004). Loggerheads may be particularly affected by organochlorine contaminants as they were observed to have the highest organochlorine contaminant concentrations in sampled tissues (Storelli et al. 2008). It is thought that dietary preferences were likely to be the main differentiating factor among species. Storelli et al. (2008) analyzed tissues from stranded loggerhead sea turtles and found that mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals and porpoises (Law et al. 1991). Recent efforts have led to improvements in regional water quality in the action area, although the more persistent chemicals are still detected and are expected to endure for years (Mearns 2001; Grant and Ross 2002). Acute exposure to hydrocarbons from petroleum products released into the environment via oil spills and other discharges may directly injure individuals through skin contact with oils (Geraci 1990), inhalation at the water's surface and ingesting compounds while feeding (Matkin and Saulitis 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability in the action area. In 2010, there was a massive oil spill in the Gulf of Mexico at British Petroleum's DWH well. Official estimates are that 4.9 million barrels of oil were released into the Gulf, with some experts estimating even higher volumes. At this time the assessment of total direct impact to sea turtles has not been determined. Additionally, the long-term impacts to sea turtles as a result of habitat impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known. More detailed information on the effects of oil spills affecting populations in the action area, including the potential impacts of the 2010 DWH oil spill are described in the Environmental Baseline section of this document.

There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. NOAA's climate information portal provides basic background information on these and other measured or anticipated effects (see http://www.climate.gov).

Climate change impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty; however significant impacts to the hatchling sex ratios of loggerhead turtles may result (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 25°-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007c). 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 with an earlier onset of loggerhead nesting in the spring (Weishampel et al. 2004; Hawkes et al. 2007), as well as short inter-nesting intervals (Hays 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). These impacts will be exacerbated by sea level rise. If females nest on the seaward side of the erosion control structures, nests may be exposed to repeated tidal overwash (NMFS and USFWS 2007c). Sea level rise from global climate change is also a potential problem 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., ocean acidification, 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 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 from various fisheries and other marine activities. Recent actions have taken significant steps towards reducing the recurring sources of mortality of sea turtles in the environmental baseline and improving the status of all loggerhead subpopulations. For example, the Turtle Excluder Device (TED) regulation published on February 21, 2003 (68 FR 8456), represents a significant improvement in the baseline effects of trawl fisheries on loggerhead sea turtles, though shrimp trawling is still considered to be one of the largest source of anthropogenic mortality on loggerheads (NMFS-SEFSC 2009d).

3.2.2 Green Sea Turtle

The green sea turtle was listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations which were listed as endangered. Critical habitat for the green sea turtle has been designated on September 2, 1998, for the waters surrounding Isla Culebra, Puerto Rico, and its associated keys. No critical habitat exists in the action area for this consultation.

Species Description, Distribution, and Population Structure

Green sea turtles have a smooth carapace with four pairs of lateral (or costal) scutes and a single pair of elongated prefrontal scales between the eyes. They typically have a black dorsal surface and a white ventral surface although the carapace of green sea turtles in the Atlantic Ocean has been known to change in color from solid black to a variety of shades of grey, green, brown and black in starburst or irregular patterns (Lagueux 2001).

Green sea turtles are distributed circumglobally, mainly in waters between the northern and southern 20^{o} C isotherms (Hirth 1971) and nesting occurs in more than 80 countries worldwide (Hirth and USFWS 1997). The two largest nesting populations are found at Tortuguero, on the Caribbean coast of Costa Rica, and Raine Island, on the Great Barrier Reef in Australia. The complete nesting range of green sea turtles within the southeastern U.S. includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands between Texas and North Carolina as well as the USVI and Puerto Rico (NMFS and USFWS 1991; Dow et al. 2007). However, the vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Johnson and Ehrhart 1994; Meylan et al. 1995). Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard through Broward counties. For more information on green sea turtle nesting in other ocean basins, refer to the 1991 Recovery Plan for the Atlantic Green Turtle (NMFS and USFWS 1991) or the 2007 Green Sea Turtle 5-Year Status Review (NMFS and USFWS 2007a).

In U.S. Atlantic and Gulf of Mexico waters, green turtles are found in inshore and nearshore waters from Texas to Massachusetts. Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Hildebrand 1982; Doughty 1984; 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 in Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward Counties (Guseman and Ehrhart 1992; Wershoven and Wershoven 1992). 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). Additional important foraging areas in the western Atlantic include the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean coast of Panama, scattered areas along Colombia and Brazil (Hirth 1971), and the northwestern coast of the Yucatan Peninsula.

Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs (Hays et al. 2001) and, like loggerheads, are known to migrate from northern areas in the summer back to warmer southern waters to the south in the fall and winter to avoid seasonally cold seawater temperatures. In terms of genetic structure, regional subpopulations show distinctive mitochondrial DNA properties for each nesting rookery (Bowen et al. 1992; Fitzsimmons et al. 2006). Despite the genetic differences, turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species' range. However, such mixing occurs at extremely low levels in Hawaiian foraging areas, perhaps making this central Pacific population the most isolated of all green turtle populations occurring worldwide (Dutton et al. 2008).

Life History Information

Green sea turtles exhibit particularly slow growth rates [about 1-5 centimeters per year (Green 1993; McDonald-Dutton and Dutton 1998)] and also have one of the longest ages to maturity of any sea turtle species [i.e. 20-50 years (Chaloupka and Musick 1997; Hirth and USFWS 1997)]. The slow growth rates are believed to be a consequence of their largely herbivorous, low-net energy diet (Bjorndal 1982). Upon reaching sexual maturity, females begin returning to their natal beaches (i.e., the same beaches where they were born) to lay eggs (Balazs 1982; Frazer and Ehrhart 1985) and are capable of migrating significant distances (hundreds to thousands of kilometers) between foraging and nesting areas. While females lay eggs every 2-4 years, males are known to reproduce every year (Balazs 1983).

Green sea turtle mating occurs in the waters off nesting beaches. In the southeastern U.S., females generally nest between June and September, and peak nesting occurs in June and July (Witherington and Ehrhart 1989). During the nesting season, females nest at approximately two-week intervals, laying an average of 3-4 clutches (Johnson and Ehrhart 1996). Clutch size often varies among subpopulations, but mean clutch size is around 110-115 eggs. In Florida, green sea turtle nests contain an average of 136 eggs (Witherington and Ehrhart 1989), which will incubate for approximately two months before hatching. Survivorship at any particular nesting site is greatly influenced by the level of anthropogenic stressors, with the more pristine and less disturbed nesting sites (e.g., Great Barrier Reef in Australia) showing higher survivorship values than nesting sites known to be highly disturbed (e.g., Nicarauga) (Campbell and Lagueux 2005; Chaloupka and Limpus 2005). After emerging from the nest, hatchlings swim to offshore areas and go through a posthatchling pelagic stage where they are believed to live for several years, feeding close to the surface on a variety of marine algae and other life associated with drift lines and other debris. This early oceanic phase remains one of the most poorly understood aspects of green turtle life history (NMFS and USFWS 2007b). However, at approximately 20- to 25-cm caprapace length, juveniles leave pelagic habitats and enter benthic foraging habitats. Growth studies using skeletochronology indicate that for green sea turtles in the Western Atlantic shift from the oceanic phase to nearshore development habitats (protected lagoons and open coastal areas rich in sea grass and marine algae) after approximately 5-6 years (Zug and Glor 1998; Bresette et al. 2006). As adults, they feed almost exclusively on sea grasses and algae in shallow bays, lagoons, and reefs (Rebel and Ingle 1974) although some populations are known to also feed heavily on invertebrates (Carballo et al. 2002). While in coastal habitats, green sea turtles exhibit site fidelity to specific foraging and nesting grounds and it is clear they are capable of "homing in" on these sites if displaced (McMichael et al. 2003). Reproductive migrations of Florida green turtles have been identified through flipper tagging and/or satellite telemetry. Based on these studies, the majority of adult female Florida green turtles are believed to reside in nearshore foraging areas throughout the Florida Keys from Key Largo to the Dry Tortugas and in the waters southwest of Cape Sable, Florida, with some post-nesting turtles also residing in Bahamian waters as well (NMFS and USFWS 2007b).

Abundance and Trends

A summary of nesting trends is provided in the most recent 5-year status review for the species (NMFS and USFWS 2007b) in which the authors collected and organized abundance data from 46 individual nesting concentrations organized by ocean region (i.e. Western Atlantic Ocean, Central Atlantic Ocean, Eastern Atlantic Ocean, Mediterranean Sea, Western Indian Ocean, Northern Indian Ocean, Eastern Indian Ocean, Southeast Asia, Western Pacific Ocean, Central Pacific Ocean, and Eastern Pacific Ocean). The authors were able to determine trends at 23 of the 46 nesting sites and found that 10 appeared to be increasing, 9 appeared to be stable, and 4 appeared to be decreasing. With respect to regional trends, the Pacific, the Western Atlantic, and the Central Atlantic regions appeared to show more positive trends (i.e., more nesting sites increasing than decreasing) while the Southeast Asia, Eastern Indian Ocean, and possibly the Mediterranean Sea regions appeared to show more negative trends (i.e., more nesting sites decreasing than increasing). These regional determinations should be viewed with caution since trend data was only available for about half of the total nesting concentration sites examined in the review and that site specific data availability appeared to vary across all regions.

The western Atlantic region (focus of this opinion) was one of the best performing in terms of abundance in the entire review as there were no sites that appeared to be decreasing. 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 sites 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. 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). More information about site specific trends for the other major ocean regions can be found in the most recent 5-year status review for the species (see NMFS and USFWS (2007a)).

By far, the largest known nesting assemblage in the western Atlantic region occurs at Tortuguero, Costa Rica. According to monitoring data on nest counts as well as documented emergences (both nesting and non-nesting events), there appears to be an increasing trend in this nesting assemblage since monitoring began in the early 1970’s. For instance, from 1971-1975 there were approximately 41,250 average emergences documented per year and this number increased to an average of 72,200 emergences documented per year from 1992-1996 (Bjorndal et al. 1999). Troëng and Rankin (Troëng and Rankin 2005) collected nest counts from 1999-2003 and also reported increasing trends in the population consistent with the earlier studies, with nest count data suggesting 17,402-37,290 females per year (NMFS and USFWS 2007a). Modeling by (Chaloupka et al. 2008) using data sets of 25 years or more resulted in an estimate of the Tortuguero, Costa Rica, population growing at 4.9 percent annually. 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 continental U.S., green turtle nesting occurs along the Atlantic coast, primarily along the central and southeast coast of Florida where an estimated 200-1,100 females nest each year (Meylan et al. 1994; Weishampel et al. 2003). Occasional nesting has also been documented along the Gulf coast of Florida 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. In 2010, a total of 18 nests were found in North Carolina, 6 nests in South Carolina, and 6 nests in Georgia (nesting databases maintained on www.seaturtle.org). 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).

In Florida, index beaches were established to standardize data collection methods and effort on key nesting beaches. Since establishment of the index beaches in 1989 up until recently, the pattern of green turtle nesting has shown biennial peaks in abundance with a generally positive trend during the ten years of regular monitoring. According to data collected from Florida's index nesting beach survey from 1989-2011, green turtle nest counts across Florida have increased approximately tenfold from a low of 267 in the early 1990's to a high of 10,701 in 2011. 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 and dropped under 3,000 in 2009, at first causing some concern, but 2010 saw an increase back to 8,426 nests on the index nesting beaches and then the high of 10,701was measured in 2011 (FWC Index Nesting Beach Survey Database). Modeling by (Chaloupka and Balazs 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.

There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas of the southeastern United States, where they come to forage. Ehrhart et al. (2007) have 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. There are also significant and ongoing threats to green sea turtles from human-related causes in the United States. Similar to that described in more detail above for loggerhead sea turtles, 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, interactions with fishing gear, and oils spills. For all sea turtle species, the potential impacts of the 2010 oil well release are described in the Environmental Baseline section of this document.

Fibropapillomatosis disease is an increasing threat to green sea turtles. Presently, this disease is cosmopolitan and has been found to affect large numbers of animals in some areas, including Hawaii and Florida (Jacobson 1990; Jacobson et al. 1991; Herbst 1994). Other sources of natural mortality include cold-stunning and biotoxin exposure. Cold-stunning is not considered a major source of mortality in most cases. As temperatures fall below 8°-10°C, turtles may lose their ability to swim and dive, often floating to the surface. The rate of cooling that precipitates cold-stunning appears to be the primary threat, rather than the water temperature itself (Milton and Lutz 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold-stunning because temperature changes are most rapid in shallow water (Witherington and Ehrhart 1989). During January 2010, an unusually large cold-stunning event in the southeastern United States resulted in around 4,600 sea turtles, mostly greens, found cold-stunned, with hundreds found dead or dying. A large cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1650 green turtles being found cold-stunned in Texas. Of these, approximately 620 were found dead or died after stranding and approximately 1030 were rehabilitated and released. Additionally, during this same time frame, approximately 340 green turtles were found cold-stunned in Mexico, with approximately 300 of those reported as being subsequently released.

The likely effects of global climate change discussed previously for loggerheads also apply to green turtles. Additionally, green sea turtle hatchling size also appears to be influenced by incubation temperatures, with smaller hatchlings produced at higher temperatures (Glen et al. 2003).

3.2.3 Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its entire range on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act of 1969, a precursor to the ESA. Critical habitat was designated in 1979 in coastal waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands. Designation of critical habitat in the Pacific Ocean occurred on January 26, 2012 (77 FR 4170). This designation includes approximately 16,910 square miles (43,798 square km) stretching along the California coast from Point Arena to Point Arguello east of the 3,000 meter depth contour; and 25,004 square miles (64,760 square km) stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meter depth contour.

Species Description, Distribution, and Population Structure

The leatherback is the largest sea turtle in the world. Mature males and females can reach lengths of over 2 m and weigh close to 900 kg (or 2000 lbs). The leatherback is the only sea turtle that lacks a hard, bony shell. A leatherback's carapace is approximately 4 cm thick and consists of a leathery, oil-saturated connective tissue overlaying loosely interlocking dermal bones. The ridged carapace and large flippers are characteristics that make the leatherback uniquely equipped for long distance foraging migrations. Leatherbacks lack the crushing chewing plates characteristic of sea turtles that feed on hard-bodied prey (Pritchard 1971). Instead, they have pointed toothlike cusps and sharp edged jaws that are perfectly adapted for a diet of soft-bodied pelagic (open ocean) prey, such as jellyfish and salps. A leatherback's mouth and throat also have backward-pointing spines that help retain gelatinous prey.

The leatherback sea turtle ranges farther than any other sea turtle species, exhibiting broad thermal tolerances (NMFS and USFWS 1995). They forage in temperate and subpolar regions between latitudes 71º N and 47º S in all oceans and undergo extensive migrations to and from their tropical nesting beaches. 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 located in French Guiana and Suriname (NMFS-SEFSC 2001).

Previous genetic analyses of leatherbacks using only mitochondrial DNA (mtDNA) suggested that within the Atlantic basin there were at least three genetically distinct 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. 1998). Further genetic analyses using microsatellite markers 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). General differences in migration patterns and foraging grounds may occur between the seven nesting assemblages, although data to support this is limited in most cases.

Life History Information

Leatherbacks are a long-lived sea turtle species, with some individuals reaching 30 years of age or older. Past estimates showed that they reached sexual maturity faster than most other sea turtle species as Rhodin (1985) reported maturity for leatherbacks occurring at 3-6 years of age while Zug and Parham (1996) reported maturity occurring at 13-14 years of age. More 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). Female leatherbacks lay up to 10 nests during the nesting season (March through July in the U.S.) at 2-3 year intervals. 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. After 60-65 days, leatherback hatchlings with white striping along the ridges of their backs and on the margins of the flippers emerge from the nest. Leatherback hatchlings are approximately 50-77 cm in length, with fore flippers as long as their bodies, and weigh approximately 40-50 g. Although leatherbacks forage in coastal waters, they appear to remain primarily pelagic through all life stages (Heppell et al. 2003). Eckert (1999) found that leatherback juveniles remain in waters warmer than 26ºC until they exceed 100 cm in length. The location and abundance of prey, including medusae, siphonophores, and salpae, in temperate and boreal latitudes likely has a strong influence on leatherback distribution in these areas (Plotkin 1995). Leatherbacks are known to be deep divers, with recorded depths in excess of a half mile (Eckert et al. 1989), but may also come into shallow waters to locate prey items.

Abundance and Trends
The status of the Atlantic leatherback population has been less clear than the Pacific population, which has shown dramatic declines at many nesting sites (Spotila et al. 2000; Sarti Martínez et al. 2007). 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, 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 observed 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 had shown large 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 et al. 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 (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). Other modeling of the nesting data for Tortuguero indicates a possible 67.8 percent decline between 1995 and 2006 (Troëng and Chaloupka 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 (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, followed by 265 nests in 2008, a record 615 nests in 2009, a slight decline to 552 nests in 2010, and then a new record of 625 nests in 2011 (FWC Index Nesting Beach Survey Database). This up-and-down pattern is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting, but overall the trend shows rapid growth on Florida's east coast beaches.

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. 2007). Fretey et al. (2007) 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 (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 to ascertain 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. 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 adult females (considering both nesting and interesting 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 (TEWG 2007).

Threats

Anthropogenic impacts to the leatherback population are similar to those facing other sea turtle species including interactions with fishery gear, marine pollution, destruction of foraging habitat, and threats to nesting beaches (see loggerhead status and trends section for more information on these threats). Of all the extant sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, especially gillnet and pot/trap lines used in various fisheries around the world. 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, their method of locomotion, and/or perhaps their attraction to the lightsticks used to attract target species in longline fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine and many other stranded individuals exhibited evidence of prior entanglement (Dwyer et al. 2002). For many years, the use of turtle excluder devices (TEDs) required for use in many U.S. fisheries were less effective at excluding the larger leatherback sea turtles compared to the smaller, hard-shelled turtle species. However, modifications to the design of TEDs have been required since 2003 that are expected to have reduced the amount of leatherback deaths that result from net capture. Zug and Parham (1996) point out that a combination of the loss of long-lived adults in fishery-related mortalities and a lack of recruitment from intense egg harvesting in some areas has caused a sharp decline in leatherback sea turtle populations and represents a significant threat to survival and recovery of the species worldwide. Leatherback sea turtles may also be more susceptible to marine debris ingestion than other sea turtle species due to their predominantly pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding and migratory purposes (Shoop and Kenney 1992; Lutcavage et al. 1997).

Investigations of the stomach contents of leatherback sea turtles revealed that a substantial percentage (44 percent of the 16 cases examined) contained some form of plastic debris (Mrosovsky 1981). The presence of plastic in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and forms of debris such a plastic bags (Mrosovsky et al. 2009). 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. Just as with other sea turtles, nesting and foraging leatherback sea turtles are subjected to the effects from past and present oil spills occurring in the Gulf of Mexico and other regions (see loggerhead sea turtle status section for more information). At the time of this consultation, no confirmed deaths of leatherbacks have been recorded in the vicinity of the *Deep Water Horizon* spill site, although this does not mean that no mortality has occurred (NMFS et al. 2011). In addition to direct contact, ingestion of oil-contaminated prey items represents a particular threat to leatherbacks emanating from the *Deep Water Horizon* spill in the Gulf of Mexico and this may continue to be a threat to recovery in the years ahead.

As discussed in more detail in the loggerhead section above, global climate change can be expected to have various impacts on all sea turtles, including leatherbacks. Global climate change is likely to also influence the distribution and abundance of jellyfish, the primary prey item of leatherbacks (NMFS and USFWS 2007c). 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)]; however, more studies need to be done to monitor how changes to prey items affect distribution and foraging success of leatherbacks so that population-level effects can be determined.

3.2.4 Hawksbill Sea Turtle

The hawksbill sea turtle was listed as endangered throughout its entire range on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act of 1969, a precursor to the ESA. Critical habitat was designated on June 2, 1998 in coastal waters surrounding Mona and Monito Islands in Puerto Rico (63 FR 46693). No critical habitat exists within the action area for this consultation.

Species Description, Distribution, and Population Structure

Hawksbill sea turtles are small to medium-sized (45 to 68 kilograms on average) although nesting females are known to weigh up to 80 kilograms in the Caribbean (Pritchard et al. 1983). The carapace is usually serrated and has a "tortoise-shell" coloring, ranging from dark to golden brown, with streaks of orange, red, and/or black. The plastron of a hawksbill turtle is typically yellow. The head is elongated and tapers to a point, with a beak-like mouth that gives the species its name. The shape of the mouth allows the hawksbill turtle to reach into holes and crevices of coral reefs to find sponges, their primary food source as adults, and other invertebrates. The shells of hatchlings are 42 mm long and are mostly brown and somewhat heart-shaped (Hillis and Mackay 1989; Van Dam and Sarti 1989; Eckert 1995).

Hawksbill turtles have a circumtropical distribution and usually occur between latitudes 30° N and 30° S in the Atlantic, Pacific, and Indian Oceans. In the western Atlantic, hawksbills are widely distributed throughout the Caribbean Sea, off the coasts of Florida and Texas in the continental U.S., in the Greater and Lesser Antilles, and along the mainland of Central America south to Brazil (Lund 1985; Plotkin and Amos 1988; Amos 1989; Groombridge and Luxmoore 1989; Plotkin and Amos 1990; NMFS and USFWS 1998b; Meylan and Donnelly 1999). They are highly migratory and use a wide range of habitats during their lifetimes (Musick and Limpus 1997; Plotkin 2003). Adult hawksbill turtles are capable of migrating long distances between nesting beaches and foraging areas. For instance, a female hawksbill sea turtle tagged in BIRNM was later identified 1,160 miles (1,866 kilometers) away in the Miskito Cays in Nicaragua (Spotila 2004).

Hawksbill sea turtles nest on insular and sandy beaches throughout the tropics and subtropics. Nesting occurs in at least 70 countries, although much of it now only occurs at low densities compared to other sea turtle species (NMFS and USFWS 2007b). It is believed that the widely dispersed nesting areas as well as the often low densities seen on nesting beaches is likely a result of overexploitation of previously large colonies that have since been depleted over time (Meylan and Donnelly 1999). The most significant nesting within the U.S. occurs in Puerto Rico and the USVI, specifically on Mona Island and Buck Island Reef National Monument, respectively. Although nesting within the continental U.S. is typically rare, it can also occur along the southeast coast of Florida and the Florida Keys. The largest hawksbill nesting population in the Western Atlantic occurs in the Yucatán Península of Mexico, where several thousand nests are recorded annually in the states of Campeche, Yucatán, and Quintana Roo (Garduno-Andrade et al. 1999; Spotila 2004). In the U.S. Pacific, hawksbills nest on main island beaches in Hawaii, primarily along the east coast of the island. Hawksbill nesting has also been documented in American Samoa and Guam. More information on nesting in other ocean basins may be found in the 5-year status review for the species (NMFS and USFWS 2007b).

Mitochondrial DNA studies show that reproductive populations are effectively isolated over ecological time scales (Bass et al. 1996). Substantial efforts have been made to determine the nesting population origins of hawksbill sea turtles assembled in foraging grounds, and genetic research has shown that hawksbills of multiple nesting origins commonly mix in foraging areas (Bowen et al. 1996). The fact that hawksbills exhibit site fidelity to their natal beaches suggests that if subpopulations become extirpated they may not be replenished by recruitment from other nesting rookeries (Bass et al. 1996).

Life History Information

Hawksbill sea turtles exhibit slow growth rates although they are known to vary within and among populations from a low of 1-3 cm per year measured in the Indo-Pacific (Chaloupka and Limpus 1997; Whiting 2000; Mortimer et al. 2002; Mortimer et al. 2003) to a high of 5 cm or more per year measured at some sites in the Caribbean (León and Diez 1999; Diez and Dam 2002). Differences in growth rates are likely due to differences in diet and/or density of turtles at foraging sites and overall time spent foraging (Bjorndal et al. 2000; Chaloupka et al. 2004). Consistent with slow growth, age to maturity for the species is also long, taking between 20 and 40 years depending on the region (Chaloupka and Musick 1997; Limpus and Miller 2000). Hawksbills in the western Atlantic are known to mature faster (i.e. 20 or more years) than turtles found in the Indo-Pacific (i.e. 30-40 years) based on studies performed in these areas (Boulan 1983; Boulon 1994; Limpus and Miller 2000; Diez and Dam 2002). Males are typically mature when their length reaches 69 cm while females are typically mature at 75 cm (Eckert et al. 1992; Limpus 1992). Female hawksbills return to their natal beaches every 2-3 years to nest (Witzell 1983; Van Dam et al. 1991) and generally lay 3-5 nests per season (Richardson et al. 1999). Compared with other sea turtles, clutch size for hawksbills can be quite high (e.g., up to 250 eggs per clutch) (Hirth and Abdel Latif 1980). Hawksbills may undertake developmental migrations (migrations as immatures) and reproductive migrations that involve travel over hundreds or thousands of kilometers (Meylan 1999). Post-hatchlings (oceanic stage juveniles) are believed to occupy the pelagic environment, taking shelter in floating algal mats and drift lines of flotsam and jetsam in the Atlantic and Pacific oceans (Musick and Limpus 1997) before recruiting to more coastal foraging grounds. In the Caribbean, hawksbills are known to almost exclusively feed on sponges (Meylan 1988; Van Dam and Diez 1997) although at times they have been seen foraging on other food items, notably corallimorphs and zooanthids (Van Dam and Diez 1997; Mayor et al. 1998; Leon and Diez 2000).

Reproductive females undertake periodic (usually non-annual) migrations to their natal beach to nest and exhibit a high degree of fidelity to their nest sites. Movements of reproductive males are less certain, but are presumed to involve migrations to the nesting each or to courtship stations along the migratory corridor. Hawksbills show a high fidelity to their foraging areas as well (Van Dam and Diez 1998). Foraging sites are typically areas associated with coral reefs although hawksbills are also found around rocky outcrops and high energy shoals which are optimum sites for sponge growth. They can also inhabit seagrass pastures in mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent (Bjorndal 1997; Van Dam and Diez 1998).

Abundance and Trends

There are currently no reliable estimates of population abundance and trends for nonnesting hawksbills at the time of this consultation; therefore, nesting beach data is currently the primary information source for evaluating trends in global abundance. Most hawksbill populations around the globe are either declining, depleted, and/or remnants of larger aggregations (NMFS and USFWS 2007b). The largest nesting population of hawksbills appears to occur in Australia where approximately 2,000 hawksbills nest off the northwest coast and about 6,000 to 8,000 nest off the Great Barrier Reef each year (Spotila 2004). Additionally, about 2,000 hawksbills nest each year in Indonesia and 1,000 nest in the Republic of Seychelles (Spotila 2004). In the U.S., about 500-1,000 hawksbill nests are laid on Mona Island, Puerto Rico (Diez and van Dam 2007) and another 56-150 nests are laid on Buck Island off St. Croix (Meylan 1999; Mortimer and Donnelly 2008). Nesting also occurs to a lesser extent on other additional beaches on St. Croix, St. John, St. Thomas, Culebra Island, Vieques Island, and mainland Puerto Rico. Mortimer and Donnelly (2008) reviewed nesting data for 83 nesting concentrations organized among 10 different ocean regions (i.e. Insular Caribbean, Western Caribbean Mainland, Southwestern Atlantic Ocean, Eastern Atlantic Ocean, Southwestern Indian Ocean, Northwestern Indian Ocean, Central Indian Ocean, Eastern Indian Ocean, Western Pacific Ocean, Central Pacific Ocean, and Eastern Pacific Ocean). Historic trends (i.e., 20-100 year time period) were determined for 58 of the 83 sites while recent abundance trends (i.e., within the past 20 years) were also determined for 42 of the 83 sites. Among the 58 sites where historic trends could be determined, all showed a declining trend during the long term period. Among the 42 sites where recent trend data were available, 10 appeared to be increasing, 3 appeared to be stable, and 29 appeared to be decreasing. With respect to regional trends, nesting populations in the Atlantic (especially in the Insular Caribbean and Western Caribbean Mainland) are generally doing better than those in the Indo-Pacific regions. For instance, 9 of the 10 sites showing recent increases were all located in the Caribbean. Nesting concentrations in the Pacific Ocean appear to be performing the worst of all regions despite the fact that the region currently supports more nesting hawksbills than either the Atlantic or Indian Oceans (Mortimer and Donnelly 2008). Buck Island and St. Croix’s East End beaches support two remnant populations of between 17-30 nesting females per season (Hillis and Mackay 1989; Mackay 2006). While the proportion of hawksbills nesting on Buck Island represents a small proportion of the total hawksbill nesting occurring in the greater Caribbean region, Mortimer and Donnelly (2008) report an increasing trend in nesting at that site based on data collected from 2001-2006. This increase is likely due to the conservation measures implemented when Buck Island Reef National Monument was expanded in 2001. More information about site specific trends for can be found in the most recent five year status review for the species [see (NMFS and USFWS 2007b)].

Threats

The historical decline of the species is primarily attributed to centuries of exploitation for the beautifully patterned shell which made it a highly attractive species to target (Parsons 1972). The fact that reproductive females exhibit a high fidelity for nest sites and the tendency of hawksbills to nest at regular intervals within a season made them an easy target for capture on nesting beaches. The tortoiseshell from hundreds of thousands of turtles in the western

Caribbean region was imported into the United Kingdom and France during the 19th and early 20th centuries (Parsons 1972) and additional hundreds of thousands of turtles contributed to the region's trade with Japan prior to 1993 when a zero quota was imposed (Milliken and Tokunaga 1987) as cited in (Brautigram and Eckert 2006).

The continuing demand for the hawksbill's shell as well as other products (leather, oil, perfume, and cosmetics) represents an ongoing threat to recovery of the species. The British Virgin Islands, Cayman Islands, Cuba, Haiti, and the Turks and Caicos Islands (U.K.) all permit some form of legal take of hawksbill turtles. In the northern Caribbean, hawksbills continue to be harvested for their shells, which are often carved into hair clips, combs, jewelry, and other trinkets (Márquez M 1990; Stapleton and Stapleton 2006). Additionally, hawksbills are harvested for their eggs and meat while whole stuffed turtles are sold as curios in the tourist trade. Also, hawksbill sea turtle products are openly available in the Dominican Republic and Jamaica despite a prohibition on harvesting hawksbills and their eggs (Fleming 2001). In Cuba, 500 turtles are legally captured each year and while current nesting trends are unknown, the number of nesting females is suspected to be declining in some areas (Carillo et al. 1999; Moncada et al. 1999). International trade in the shell of this species is prohibited between countries that have signed the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), but illegal trade is still occurring and remains an ongoing threat to hawksbill survival and recovery throughout its range.

Due to their preference to feed on sponges associated with coral reefs, hawksbill sea turtles are particularly sensitive to losses of coral reef communities. Coral reefs are vulnerable to destruction and degradation caused by human activities (e.g. nutrient pollution, sedimentation, contaminant spills, vessel groundings and anchoring, recreational uses, etc.) and are also highly sensitive to the effects of climate change (e.g. higher incidences of disease and coral bleaching) (Wilkinson 2004; Crabbe 2008). Continued loss of coral reef communities (especially in the greater Caribbean region) is expected to impact foraging and represents a major threat to recovery of the species.

Hawksbills are also currently subject to the same suite of threats on both nesting beaches and in the marine environment that affect other sea turtles (e.g. interaction with federal and state fisheries, coastal construction, oil spills, climate change affecting sex ratios, etc.) as discussed in the loggerhead sea turtle status section Hawksbill sea turtles are also susceptible to capture in nearshore artisanal fishing gear such as drift-netting, long-lining, set-netting, and trawl fisheries with gill nets and artisanal hook and line representing the greatest impact to the species in the greater Caribbean region [(NRC 1990; Lutcavage et al. 1997; Epperly 2003)]. For all sea turtles, more detailed information on potential impacts of the 2010 DWH oil spill are described in the Environmental Baseline section of this document.

3.2.5 Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle was listed as endangered throughout its entire range on December 2, 1970 under the Endangered Species Conservation Act of 1969, a precursor to the ESA. No critical habitat has been designated for the species.

Species Description, Distribution, and Population Structure

The Kemp's ridley sea turtle is the smallest of all extant sea turtles with adults generally weighing less than 45 kilograms and having a carapace length of around 65 centimeters. Adults have an almost circular carapace with a grayish green color while the plastron is often pale yellow. There are two pairs of prefrontal scales on the head, five vertebral scutes, and five pairs of costal scutes. In the bridge adjoining the plastron to the carapace, there are four scutes, each of which is perforated by a pore. Hatchlings are usually grayish-black in color and weigh between 15-20 grams. This species has a very restricted range relative to other sea turtle species with most adults occurring in the Gulf of Mexico in shallow near shore waters, although adult-sized individuals sometimes are found on the eastern seaboard of the United States as well. Nesting is essentially limited to the beaches of the western Gulf of Mexico, primarily in the Mexican state of Tamaulipas, although few nests have also been recorded in Florida and the Carolinas (Meylan et al. 1995). Kemp's ridleys nest in daytime aggregations known as "arribadas", primarily at Rancho Nuevo, a stretch of beach in Mexico. Most of the population of adult females nests in this single locality (Pritchard 1969).

Life History Information

Kemp's ridley sea turtles reach sexual maturity at 7-15 years of age. While some turtles nest annually, the weighted mean remigration rate is approximately two years. Nesting generally occurs from April to July and females lay approximately 2.5 nests per season with each nest containing approximately 100 eggs (Márquez M 1994). Studies have shown that the time spent in the post-hatchling pelagic stage can vary from 1-4 years time, while the benthic immature stage typically lasts approximately 7-9 years (Schmid and Witzell 1997). Little is known of the movements of the post-hatching, planktonic stage within the Gulf of Mexico although the turtles during this stage are assumed to associate with floating seaweed (e.g. *Sargassum spp.*) where they would presumably feed on the available sargassum and associated infauna or other epipelagic species found in the Gulf of Mexico. Atlantic juveniles/subadults travel northward with vernal warming to feed in the productive, coastal waters of Georgia through New England, returning southward with the onset of winter to escape the cold (Lutcavage and Musick 1985; Henwood and Ogren 1987; Ogren 1989). Upon leaving Chesapeake Bay in autumn, juvenile ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined there by juveniles of the same size from North Carolina sounds and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Epperly et al. 1995b; Epperly et al. 1995c; Musick and Limpus 1997). Adult Kemp's ridleys primarily occupy neritic habitats, typically containing muddy or sandy bottoms where prey can be found. In the post-pelagic stages, Kemp's ridley sea turtles are largely cancrivorous (crab eating), with a preference for portunid crabs (Bjorndal 1997). Stomach contents of Kemp's ridleys along the lower Texas coast consisted of a predominance of nearshore crabs and mollusks, as well as fish, shrimp and other foods considered to be scavenged discards from the shrimping industry (Shaver 1991).

Abundance and Trends

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 in the 1990's suggested 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 nesting database 2007). In 2008, there were 17,882 nests in Mexico (Gladys Porter Zoo 2008), and nesting in 2009 reached 21,144 (Gladys Porter Zoo 2010). In 2010, nesting declined significantly, to 13,302 (Gladys Porter Zoo 2010). Nesting numbers rebounded from 2010's reduced nesting to 20,570 (Gladys Porter Zoo 2011). A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 128 in 2007, 195 in 2008, and 197 in 2009. Texas nesting then experienced a decline similar to that seen in Mexico for 2010, with 140 nests (National Park Service data, http://www.nps.gov/pais/naturescience/strp.htm), but nesting rebounded in 2011 with a record 199 nests (National Park Service data, http://www.nps.gov/pais/naturescience/current-season.htm).

Heppell et al. (2005) predicted in a population model that the population is expected to increase at least 12-16 percent per year and that the population could attain at least 10,000 females nesting on Mexico beaches by 2015. NMFS et al. (2011) contains an updated model which predicts that the population is expected to increase 19 percent per year and that the population could attain at least 10,000 females nesting on Mexico beaches by 2011. Approximately 25,000 nests would be needed for an estimate of 10,000 nesters on the beach, based on an average 2.5 nests/nesting female. In 2009 the population was on track with 21,144 nests, but an unexpected and as yet unexplained drop in nesting occurred in 2010 (13,302), deviating from the NMFS et al. (2011) model prediction. A subsequent increase to 20,570 nests in 2011 occurred, but we will not know if the population is continuing the trajectory predicted by the model until future nesting data is available. Of course, this updated model assumes that current survival rates within each life stage remain constant. The recent increases in Kemp's ridley sea turtle nesting seen in the last two decades is likely due to a combination of management measures including elimination of direct harvest, nest protection, the use of TEDs, reduced trawling effort in Mexico and the U.S., and possibly other changes in vital rates (TEWG 1998; TEWG 2000). While these results are encouraging, the species limited range as well as low global abundance makes it particularly vulnerable to new sources of mortality as well as demographic and environmental stochasticity all of which are often difficult to predict with any certainty.

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 (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.

The impacts of pollution on Kemp's ridley sea turtles, as with all sea turtles, are still poorly understood. There is little data to provide an understanding of how water quality impacts sea turtles. For all sea turtle species, the potential impacts of the 2010 DWH oil spill are described in the Environmental Baseline section of this document. It is expected that the acute and chronic impacts of the DWH oil spill, along with other oil spills in the Gulf of Mexico, will continue to have an impact on sea turtles, especially Kemp's ridley sea turtles, for years to come. The potential impacts of the 2010 DWH oil spill are described in greater detail in the Environmental Baseline section of this document.

Global climate change impacts as described in the section for loggerhead sea turtles above are also expected. 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.

3.2.6 Smalltooth Sawfish (U.S. DPS)

The smalltooth sawfish U.S. DPS 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 two units are located along the southwestern coast of Florida between Charlotte Harbor and Florida Bay. These areas contain the following physical and biological features that are essential to the conservation of this species: red mangroves and shallow euryhaline habitats characterized by water depths between the Mean High Water Line and three feet (0.9 meters) measured at Mean Lower Low Water.

Species Description, Distribution, and Population Structure

The smalltooth sawfish is a tropical marine and estuarine elasmobranch fish species characterized by an extended snout with a long, narrow, flattened, rostral blade with a series of transverse teeth along either edge. The rostrum has a saw-like appearance, hence the name sawfish. Although they are rays, sawfish appear in some respects to be more shark-like than ray-like, with only the trunk and the head ventrally flattened. The smalltooth sawfish is distinguished from a similar listed species, the largetooth sawfish, by lacking a defined lower caudal lobe, by having the first dorsal fin origin located over the origin of the pelvic fins (versus considerably in front of the origin of pelvics in the largetooth sawfish), and by having 20 to 34 rostral teeth on each side of the rostrum (versus 14-23 in largetooth sawfish) (Bigelow and Schroeder 1953; Thorson 1973; McEachran and Fechhelm 1998; Compagno and Last 1999). The rostrum of the smalltooth sawfish is also about a quarter of the total length of an adult specimen, somewhat longer than the rostrum of largetooth sawfish, which is about a fifth of its total length (Bigelow and Schroeder 1953).

Sawfish in general inhabit shallow waters very close to shore in muddy and sandy bottoms, seldom descending to depths greater than 32 feet (10 meters). They are often found in sheltered bays, on shallow banks, and in estuaries or river mouths (NMFS 2000). Smalltooth sawfish are euryhaline, occurring in waters with a broad range of salinities from freshwater to full seawater (Simpfendorfer 2001) and many encounters are reported at the mouths of rivers or other sources of freshwater inflows (Simpfendorfer and Wiley 2004). Whether this observation represents a preference for river mouths because of physical characteristics (e.g., salinity) or habitat factors (e.g., mangroves or prey) or both is unclear (75 FR 61904).

Historic capture records of smalltooth sawfish within the U.S. range from Texas to New York, although peninsular Florida has historically been the U.S. region with the largest number of recorded captures and likely represents the core of the historic range (NMFS 2000). Recent records indicate there is a resident reproducing population of smalltooth sawfish in south and southwest Florida from Charlotte Harbor through the Dry Tortugas which also serves as the last U.S. stronghold for the species (Seitz and Poulakis 2002; Poulakis and Seitz 2004; Simpfendorfer and Wiley 2005). Water temperatures no lower than 16-18 °C and the availability of appropriate coastal habitat serve as the major environmental constraints limiting the northern movements of smalltooth sawfish in the western North Atlantic. As a result, most records of this species from areas north of Florida occur during spring and summer periods (May to August) when inshore waters reach higher temperatures. Most specimens captured along the Atlantic coast north of Florida are large adults (over 10 feet) and likely represent seasonal migrants, wanderers, or colonizers from an historic Florida core population(s) to the south rather than being members of a continuous, even-density population (Bigelow and Schroeder 1953). The coastal habitat of sawfish suggests that their biology may favor the isolation of populations that may be unable to traverse large expanses of deep water or otherwise unsuitable habitat (Faria 2007).

Life History Information
Smalltooth sawfish are approximately 31 inches (80 centimeters) at birth (Simpfendorfer 2002) and may grow to a length of 18 feet (540 centimeters) or greater during their lifetime (Bigelow and Schroeder 1953). A recent study by Simpfendorfer et al. (2008) suggests rapid juvenile growth for smalltooth sawfish for the first two years after birth with stretched total length increasing by an average of 650–850 millimeters in the first year and an average of 480–680 millimeters in the second year. Using a demographic approach and life history data for smalltooth sawfish and similar species from the literature, Simpfendorfer (2000) estimated

intrinsic rates of natural population increase for the species at 0.08 to 0.13 per year and estimated population doubling times from 5.4 years to 8.5 years. These low intrinsic rates of population increase suggests that the species is particularly vulnerable to excessive mortality and rapid population declines due to stochastic events, after which recovery may take decades. Overall, much uncertainty still remains in estimating life history parameters for smalltooth sawfish since very little information exists on size classes other than juveniles. Simpfendorfer (2000) estimated that smalltooth sawfish reach sexual maturity at 10-20 years of age, while Clark et al. (2004) estimated that males reach maturity at younger ages (around 19 years old) compared to females (around 33 years old). Fertilization is internal as with all elasmobranch species and development is believed to be ovoviviparous. Bigelow and Schroeder (1953) reported gravid females carry 15–20 embryos, although the source of their data is unclear and may represent an over-estimate of the true 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 five months and females likely produce litters every second year. Although there are no studies on smalltooth sawfish reproductive traits, its similarity to the largetooth sawfish implies that their reproductive biology may be similar, but reproductive periodicity has yet to be verified for either sawfish species.

Acoustic tracking results for very small juveniles (39-79 inches or 100-200 centimeters long) indicate that they spend the vast majority of their time in very shallow water (less than one foot deep) associated with shallow mud or sand banks and within red mangrove root systems. It is hypothesized that by staying in these very shallow areas they are inaccessible to their predators (mostly sharks) and as a result increase their overall chances of survival (Simpfendorfer 2003). Acoustic monitoring studies have shown that juveniles have high levels of site fidelity for specific nursery areas for periods lasting up to almost three months (Wiley and Simpfendorfer 2007). Encounter and research data indicate there is a tendency for smalltooth sawfish to move offshore and into deeper water as they grow. An examination of the relationship between the depth at which sawfish occur and their estimated size indicates that large animals roam over a much larger depth range than juveniles with larger sawfish regularly occurring at depths greater than 32 feet (10 meter) (Simpfendorfer 2001; Poulakis and Seitz 2004; Simpfendorfer and Wiley 2004). Limited data are available on the site fidelity of adult sawfish although Seitz and Poulakis (2002) suggested that they may have some level of site fidelity for relatively short periods of time. Historic records of smalltooth sawfish indicate that some large mature individuals migrated north along the U.S. Atlantic coast as temperatures warmed in the summer and then south as temperatures cooled (Bigelow and Schroeder 1953). However, given the very limited number of encounter reports from the east coast of Florida, Simpfendorfer and Wiley (2004) hypothesize the population previously undertaking the summer migration has declined to a point where the migration is currently undetectable or does not occur at all. Smalltooth sawfish feed primarily on small fish with mullet, jacks, and ladyfish believed to be their primary food resources (Simpfendorfer 2001). By moving its saw rapidly from side to side through the water, the relatively slow-moving sawfish is able to strike at individual fish (Breder 1952). The teeth on the saw stun, impale, injure, or kill the fish. Smalltooth sawfish then rub their saw against bottom substrate to remove the fish before ingesting it. In addition to fish, smalltooth sawfish are also known to prey on crustaceans (mostly shrimp and crabs) found along the sea bottom (Norman and Fraser 1937; Bigelow and Schroeder 1953).

Abundance, Trends, and Current Threats
Few long-term abundance data sets exist for the smalltooth sawfish, making it very difficult to estimate the current population size. However, Simpfendorfer (2001) estimated that the U.S. population size may number less than five percent of historic levels based on anecdotal data and the fact that the species range has contracted by nearly 90 percent, with south and southwest Florida the only areas known to currently support a reproducing population. Seitz and Poulakis (2002) and Poulakis and Seitz (2004) documented smalltooth sawfish occurrences during the period 1990-2002 along the southwest coast of Florida, and in Florida Bay and the Florida Keys, respectively. The studies reported a total of a total of 2,969 sawfish encounters during this period. In 2000, Mote Marine Laboratory also established a smalltooth sawfish public encounter database (now currently maintained by the Florida Museum of Natural History at the University of Florida) to compile information on the distribution and abundance of sawfish. The NSED contains over 3,000 sawfish encounters reported from 2000-2012 (NSED 2012). Although encounter databases may provide a useful future means of measuring changes in the population and its distribution over time, accurate estimates concerning smalltooth sawfish abundance cannot be made at the current time because efforts are not expended evenly across each study period.

Despite the lack of data on abundance, recent encounters with neonates (young-of-the-year), juveniles, and sexually mature sawfish indicate that the Florida population is currently reproducing (Seitz and Poulakis 2002; Simpfendorfer 2003). The abundance of juveniles encountered, including very small individuals, suggests that the population remains viable (Simpfendorfer and Wiley 2004), and data analyzed from Everglades National Park as part of an established fisheries monitoring program indicate a slightly increasing trend in abundance within the park over the past decade (Carlson et al. 2007; Carlson and Osborne 2012).

While this data suggests that the species may be showing some signs of recovery in the region, encounters are still rare along much of their historical range beyond south and southwest Florida (Snelson and Williams 1981; Simpfendorfer and Wiley 2004). The primary reason for the decline in smalltooth sawfish abundance has been bycatch in various commercial and recreational fisheries, including gillnets, otter trawls, trammel nets, seines, and hook-and-line (NMFS 2009). While there never has been a large-scale directed fishery, smalltooth sawfish can easily become easily entangled in netting gear directed at other commercial species, often resulting in serious injury or death. Snelson and Williams (1981) attributed the extirpation of smalltooth sawfish from the Indian River Lagoon off the east coast of Florida to heavy mortality associated with incidental captures by commercial fishermen. For instance, one fisherman interviewed by Evermann and Bean (1898) reported taking an estimated 300 smalltooth sawfish in just one netting season. Simpfendorfer (2002) extracted a data set from 1945–1978 of smalltooth sawfish landings by Louisiana shrimp trawlers containing both landings data and crude information on effort (number of vessels, vessel tonnage, number of gear units). The data from Louisiana show that smalltooth sawfish landings declined during that period from a high of 34,900 pounds in 1949 to less than 1,500 pounds in most years after 1967. In more recent years, the highest interaction with the species is reported for the Highly Migratory Species Atlantic Shark, Gulf of Mexico Reef Fish, and the Gulf of Mexico and South Atlantic shrimp trawl fisheries.

In addition to commercial fisheries, encounter data (NSED 2012) also documents that saws are sometimes removed from sawfish caught by recreational fishermen, often to avoid injury to the fishermen themselves or to keep the saw as a type of trophy. While the current threat of mortality associated with recreational fisheries is expected to be low given that possession of the species in Florida has been prohibited since 1992, bycatch in fisheries is still the primary threat to the species.

Another major factor in the historical decline of smalltooth sawfish is due to habitat modification, especially nursery habitat for juveniles. Activities such as agricultural and urban development, commercial activities, dredge and fill operations, boating, erosion, and diversions of freshwater runoff contribute to these losses (SAFMC 1998). From 1943-1970, approximately 10,000 hectares of coastal wetlands were lost due to dredge fill and other activities including substantial losses of mangroves at specific locations throughout Florida (Odum et al. 1982). While modification of mangrove habitat is currently regulated, some permitted direct and/or indirect damage to mangrove habitat from increased urbanization still occurs and is expected to continue to threaten survival and recovery of the species in the future. For instance, many of the areas known to have been used historically by juvenile sawfish have already been drastically modified (NMFS 2009).

Smalltooth sawfish may be especially vulnerable to coastal habitat degradation due to their affinity for shallow estuarine systems. In addition to mangroves, other riverine, nearshore, and offshore areas have been dredged for navigation, construction of infrastructure, and marine mining. An analysis of 18 major southeastern estuaries (Orlando et al. 1994) recorded over 703 miles of navigation channels and 9,844 miles of shoreline modifications. Habitat effects of dredging include the loss of submerged habitats by disposal of excavated materials, turbidity and siltation effects, contaminant release, alteration of hydrodynamic regimes, and fragmentation of physical habitats (SAFMC 1998). Modifications of natural freshwater flows into estuarine and marine waters through construction of canals and other controlled devices have changed temperature, salinity, and nutrient regimes; reduced both wetlands and submerged aquatic vegetation; and degraded vast areas of coastal habitat utilized by smalltooth sawfish (Reddering 1988; Whitfield and Bruton 1989; Gilmore 1995). No specific information is available on the effects of pollution on smalltooth sawfish but evidence from other elasmobranchs suggests that pollution disrupts endocrine systems and potentially leads to reproductive failure (Gelsleichter et al. 2006). Sawfish may also alter seasonal migration patterns in response to warm water discharges from power stations (Simpfendorfer and Wiley 2005). Smalltooth sawfish is also limited by its life history characteristics as a slow growing, late maturing, and long-lived species making it particularly vulnerable to stochastic changes in its environment (NMFS 2000). These combined characteristics result in a very low intrinsic rate of population increase (Musick 1999) that also makes it slow to recover from any significant population decline (Simpfendorfer 2000).

3.2.7 Atlantic Sturgeon

Five separate distinct population segments (DPS) of the Atlantic sturgeon (*A. oxyrinchus oxyrinchus*) were listed under the ESA by NMFS on February 6, 2012 (77 FR 5880 and 5914). From north to south, the DPSs are the Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic. The New York Bight, Chesapeake Bay, Carolina, and South

Atlantic DPSs are listed as endangered, and the Gulf of Maine DPS is listed as threatened. Since adult Atlantic sturgeon mix extensively in marine waters, Atlantic sturgeon from any DPS may be encountered in the South Atlantic portion of the action area.

Life History and Distribution

Atlantic sturgeon are distributed along the eastern coast of North America. Historically, sightings have been reported from Hamilton Inlet, Labrador, south to the St. Johns River, Florida. In late 2010, a tagged Atlantic sturgeon was tracked off Cape Canaveral, Florida (T. Savoy, CTDEP, pers. comm.) Occurrences south of the St. Johns River, Florida, and in Labrador may have always been rare.

Atlantic sturgeon populations show clinal variation, with a general trend of faster growth and earlier age at maturation in more southern systems. Atlantic sturgeon mature between the ages of 5 and 19 years in South Carolina (Smith et al. 1982), between 11 and 21 years in the Hudson River (Young et al. 1988), and between 22 and 34 years in the St. Lawrence River (Scott and Crossman 1973). Atlantic sturgeon likely do not spawn every year. Multiple studies have shown that spawning intervals range from 1 to 5 years for males (Smith 1985; Collins et al. 2000; Caron et al. 2002) and 2 to 5 years for females (Vladykov and Greely 1963; Van Eenennaam et al. 1996; Stevenson and Secor 1999). Fecundity of Atlantic sturgeon has been correlated with age and body size, with egg production ranging from 400,000 to 8 million eggs per year (Smith et al. 1982; Van Eenennaam and Doroshov 1998; Dadswell 2006). The average age at which 50 percent of maximum lifetime egg production is achieved is estimated to be 29 years, approximately 3 to 10 times longer than for other bony fish species examined (Boreman 1997).

Juvenile and adult Atlantic sturgeon reside in upper estuarine habitat where they frequently congregate around the saltwater/freshwater interface. Estuarine habitats are important for juveniles, serving as nursery areas by providing abundant foraging opportunities, as well as thermal and salinity refuges, for facilitating rapid growth. Some juveniles will take up residency in non-natal rivers that lack active spawning sites (Bain 1997). Residency time of young Atlantic sturgeon in estuarine areas varies between one and six years (Smith 1985; Schueller and Peterson 2010), after which Atlantic sturgeon start outmigration to the marine environment. Outmigration of adults from the estuaries to the sea is cued by water temperature and velocity. Adult Atlantic sturgeon will reside in the marine habitat during the non-spawning season and forage extensively. Coastal migrations by adult Atlantic sturgeon are extensive and are known to occur over sand and gravel substrate (Greene et al. 2009). Atlantic sturgeon remain in the marine habitat until the waters begin to warm, at which time ripening adults migrate back to their natal rivers to spawn.

Upstream migration to the spawning grounds is cued primarily by water temperature and velocity. Therefore, fish in the southern portion of the range migrate earlier than those to the north (Smith 1985; Kieffer and Kynard 1993). In Georgia and South Carolina, this begins in February or March (Collins et al. 2000). Males commence upstream migration to the spawning sites when waters reach around 6 degrees Celsius (Smith et al. 1982; Dovel and Berggren 1983; Smith 1985) with females following a few weeks later when water temperatures are closer to 12 degrees Celsius or 13 degrees Celsius (Dovel and Berggren 1983; Smith 1985; Collins et al.

2000). In some rivers, predominantly in the south, a fall spawning migration may also occur (Rogers and Weber 1995; Moser et al. 1998), with running ripe males found August through October and post-spawning females captured in late September and October (Collins et al. 2000).

In general, sturgeon are omnivorous benthic feeders (feeding on the surface of the water bottom) and filter large quantities of substrate when they suction food into their protrusible mouth. Few diet studies have been conducted on the Atlantic sturgeon. Adult sturgeon diets are comprised of mollusks, gastropods, amphipods, isopods, and fish (ASSRT and NMFS 2007). Juvenile sturgeon feed on aquatic insects and other invertebrates (ASSRT and NMFS 2007). A recent investigation by Collins et al. (2006) indicated that sub-adult Atlantic sturgeon in both the Edisto and Savannah Rivers foraged mostly on invertebrates, with a high percentage of amphipods and polychaetes. In marine waters, Atlantic sturgeon feed on mollusks, polychaete worms, gastropods, shrimps, amphipods, isopods, and small fish (Scott and Crossman 1973). The presence of food in the stomachs of large (greater than 1.25 meters fork length) Atlantic sturgeon captured in the Edisto and Savannah Rivers demonstrates that these fish do not fast while in freshwater as previously believed (Collins et al. 2006).

Population Status

Gulf of Maine DPS

The Gulf of Maine DPS includes all anadromous Atlantic sturgeon that are spawned in the watersheds from the Maine/Canadian border and extending southward to include all associated watersheds draining into the Gulf of Maine as far south as Chatham, Massachusetts, as well as wherever these fish occur in coastal bays and estuaries and the marine environment. The marine range of Atlantic sturgeon from the Gulf of Maine DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. Population estimates for the Kennebec river system based on the landings from historical fisheries indicated that approximately 10,240 adult sturgeon were present prior to 1843. Spawning is known to occur in only one river, the Kennebec River, and possibly in one other, the Penobscot River. Elimination of historical spawning populations in five other main stem rivers within the Gulf of Maine has likely occurred. The existing spawning population is estimated to have less than 300 adults spawning each year.

New York Bight DPS

The New York Bight DPS includes all anadromous Atlantic sturgeon that are spawned in the watersheds that drain into coastal waters, including Long Island Sound, the New York Bight, and Delaware Bay, from Chatham, Massachusetts, to the Delaware-Maryland border on Fenwick Island. The marine range of Atlantic sturgeon from the New York Bight DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. Prior to 1890, there were an estimated 180,000 adult female Atlantic sturgeon spawning in the Delaware River, and 6,000 to 6,800 females contributed to the Hudson River spawning stock each year during the late 1800s. Known spawning populations exist in two rivers (the Hudson and Delaware Rivers) and elimination of at least two historic spawning populations is believed to have occurred. The existing spawning population in the Hudson River is estimated to have 870 adults spawning each year (600 males and 270 females). There is no population estimate for the Delaware River, but it is believed to have less than 300 spawning adults per year. The spawning population of this DPS is thought to be up to three orders of magnitude below historical levels.

Chesapeake Bay DPS

The Chesapeake Bay DPS includes all anadromous Atlantic sturgeon that are spawned in the watersheds that drain into the Chesapeake Bay and into coastal waters from the Delaware-Maryland border on Fenwick Island to Cape Henry, Virginia, as well as wherever these fish occur in coastal bays and estuaries and the marine environment. The marine range of Atlantic sturgeon from the Chesapeake Bay DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. Prior to 1890, when a sturgeon fishery began, it was estimated that approximately 20,000 adult females inhabited the Chesapeake Bay and its tributaries. There is only one known spawning population in the James River. Spawning may occur in the York River as well. Historical evidence suggests the Potomac, Susquehanna, and Rappahannock Rivers were also Atlantic sturgeon spawning rivers. Current evidence of Atlantic sturgeon spawning in these other rivers of the Chesapeake Bay DPS segment is lacking. The existing spawning population in the James River is estimated to have less than 300 spawning adults per year. The spawning population of this DPS is thought to be two orders of magnitude below historical levels.

Carolina DPS

The Carolina DPS includes all Atlantic sturgeon that are spawned in the watersheds (including all rivers and tributaries) from Albemarle Sound southward along the southern Virginia, North Carolina, and South Carolina coastal areas to Charleston Harbor. The marine range of Atlantic sturgeon from the Carolina DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. Historical landings data indicate that between 7,000 and 10,500 adult female Atlantic sturgeon were present in North Carolina prior to 1890 (Armstrong and Hightower 2002; Secor 2002). Secor (2002) estimates that 8,000 adult females were present in South Carolina during that same time-frame. The Atlantic sturgeon spawning population in at least one river system (the Sampit River) within the Carolina DPS has been extirpated, and the statuses of four additional spawning populations are uncertain. There are believed to be only five of 7-10 historical spawning populations remaining in the Carolina distinct population segment. In some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. The abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, are estimated to be less than 3 percent of what they were historically (ASSRT and NMFS 2007).

South Atlantic DPS

The South Atlantic DPS includes all Atlantic sturgeon that are spawned in the watersheds (including all rivers and tributaries) of the Ashepoo, Combahee, and Edisto Rivers (ACE) Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. The marine range of Atlantic sturgeon from the South Atlantic DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. Secor (2002) estimates that 8,000 adult females were present in South Carolina prior to 1890. Prior to the collapse of the fishery in the late 1800s, the sturgeon fishery was the third largest fishery in Georgia. Secor (2002) estimated from U.S. Fish Commission landing reports that approximately 11,000 spawning females were likely present in Georgia prior to 1890. The Atlantic sturgeon spawning population in at least two river systems (the St. Marys and St. Johns Rivers) within the South

Atlantic DPS has been extirpated. There are believed to be spawning populations in only six of 9-10 historical spawning rivers within the South Atlantic distinct population segment. In some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. The Altamaha River population of Atlantic sturgeon, with an estimated 343 adults spawning annually, is believed to be the largest population in the Southeast, yet is estimated to be only 6 percent of its historical population size. The abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, are estimated to be less than 1 percent of what they were historically (ASSRT and NMFS 2007).

Threats

The modification and curtailment of Atlantic sturgeon habitat resulting from dams, dredging, and degraded water quality is contributing to the status of the five Atlantic sturgeon DPSs. Dams have curtailed Atlantic sturgeon spawning and juvenile developmental habitat by blocking over 60 percent of the historical sturgeon habitat upstream of the dams in some rivers (e.g., the Cape Fear, Santee-Cooper, and St. John River systems). Water quality (velocity, temperature, and dissolved oxygen (DO)) downstream of dams has been reduced, which modifies and curtails the extent of spawning and nursery habitat available to Atlantic sturgeon. Dredging in spawning and nursery grounds modifies the quality of the habitat and is further curtailing the extent of available habitat in some rivers where Atlantic sturgeon habitat has already been modified and curtailed by the presence of dams (e.g., the Cape Fear and Savannah Rivers). Reductions in water quality from terrestrial activities (e.g., agriculture, silviculture, and industrial development) have modified habitat utilized by Atlantic sturgeon through reduced water volume and velocity, nutrient-loading, seasonal anoxia, and the input of pollutants. Additional stressors arising from water allocation and climate change threaten to exacerbate water quality problems that are already present throughout the range of Atlantic sturgeon, but particularly in the Southeast where temperatures are already generally warmer. Large interbasin water transfers are becoming increasingly common. For example, the NCDNR reports that 20 facilities with a combined average daily transfer of 66.5 million gallons of water were in existence in North Carolina prior to 2007. Since then, five additional facilities have been permitted to transfer up to a maximum of 167.5 million gallons of water per day. The removal of large amounts of water from the system will alter flows, temperature, and DO. Existing water allocation issues will likely be compounded by population growth and potentially climate change. Climate change is also predicted to elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower DO.

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to each of the five DPSs. Atlantic sturgeon are more sensitive to bycatch mortality because they are a long-lived species, have an older age at maturity, have lower maximum fecundity values, and a large percentage of egg production occurs later in life. Based on these life history traits, Boreman (1997) calculated that Atlantic sturgeon can only withstand the annual loss of up to 5 percent of their population to bycatch mortality without suffering population declines. Atlantic sturgeon are particularly vulnerable to being caught in sink gillnets, therefore fisheries using this type of gear account for a high percentage of Atlantic sturgeon bycatch and bycatch mortality.

The NMFS Northeast Fisheries Science Center updated a bycatch analysis done in 2007 by the Atlantic States Marine Fisheries Commission (Miller and Shepherd 2011). This new analysis indicates that bycatch in fisheries is still occurring in the Northeast at a rate that is unsustainable for Atlantic sturgeon survival and recovery. Little data exists on bycatch in the Southeast and high levels of bycatch underreporting are suspected. Further, a total population abundance for the five Atlantic sturgeon DPSs are not available, and it is therefore not possible to calculate the percentage of each DPS subject to bycatch mortality based on the available bycatch mortality rates for individual fisheries. However, fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may access multiple river systems, they are subject to being caught in multiple fisheries throughout their range. In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in delayed mortality or increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins and low DO). Sublethal impacts may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

Vessel strikes of Atlantic sturgeon have been documented in particular areas. Atlantic sturgeon that occur in locations that support large ports and have relatively narrow waterways appear to be more prone to vessel strikes (e.g., Delaware and James Rivers). Twenty-nine mortalities believed to be the result of vessel strikes were documented in the Delaware River from 2004 to 2008 (Kahnle et al. 2005; Murphy 2006; Brown and Murphy 2010), most likely from larger vessels, although at least one boater reported hitting a large sturgeon with his small craft (C. Shirey, DNREC, pers. comm., 2005). In the James River, 11 Atlantic sturgeon were reported to have been struck by vessels from 2005 through 2007. The propeller marks present on the six fish examined indicated that the wounds were inflicted by both large and small vessels (A. Spells, USFWS, pers. comm., 2007).

Summary of the Status of Atlantic sturgeon

The largest existing riverine population of Atlantic sturgeon in the U.S., with an estimated 870 annually spawning adults, is the Hudson River population within the New York Bight DPS. The second largest population, with an estimate 343 annually spawning adults, is the Altamaha River population within the South Atlantic DPS. All other existing spawning populations are estimated to be less than 300 annually spawning adults. The abundance of Atlantic sturgeon in the Chesapeake Bay and New York Bight DPSs are two and three orders, respectively, of magnitude smaller than historical abundance. The largest population in the Southeast, the Altamaha River population, is estimated to be 6 percent of its historical abundance. The remaining populations within the Carolina and South Atlantic DPSs are at 3 percent and 1 percent of historical levels, respectively. Atlantic sturgeon populations were originally depleted due to the directed fishery in the late 1800’s and early 1900’s. The populations have remained at their greatly reduced levels for the last century. Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon. Their late age at maturity provides more opportunities for individuals to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, this is hampered within all five Atlantic sturgeon DPSs primarily by habitat alteration, and bycatch.

3.2.8 Gulf Sturgeon

Gulf sturgeon (*Acipenser oxyrinchus desotoi*) were listed as threatened on September 30, 1991 (56 CFR 49653), after their stocks were greatly reduced or extirpated throughout much of their historic range by overfishing, dam construction, and habitat degradation. NMFS and the U.S. Fish and Wildlife Service Gulf sturgeon jointly managed Gulf sturgeon. In 2009, NMFS and USFWS conducted a 5-year review and found the Gulf sturgeon continued to meet the definition of a threatened species (USFWS and NMFS 2009).

Species Description, Distribution and Population Structure
Gulf sturgeon are nearly cylindrical fish with an extended snout, vertical mouth, 5 rows of scutes, 4 chin barbells and a heterocercal caudal fin (upper lobe is longer than lower). Adults range from 6-8 feet in length and weigh up to 200 pounds; females grow larger than males. Gulf sturgeon are anadromous fish; they spawn in freshwater then migrate to feed and grow in the estuarine/marine habitats. The Gulf sturgeon is a subspecies of the Atlantic sturgeon (*A.o.oxyrinchus*).

Historically, Gulf sturgeon occurred from the Mississippi River east to Tampa Bay. Sporadic occurrences were recorded as far west as the Rio Grande River in Texas and Mexico, and as far east and south as Florida Bay (Wooley and Crateau 1985; Reynolds 1993). The sub-species' present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi respectively, east to the Suwannee River in Florida. Currently, seven rivers are known to support reproducing populations of Gulf sturgeon: Pearl, Pascagoula, Escambia, Yellow, Choctawhatchee, Apalachicola and, Suwannee.

Tagging studies confirm that Gulf sturgeon exhibit a high degree of river fidelity (Carr 1983). Of 4,100 fish tagged, 21 percent (860 of 4100 fish) were later recaptured in the river of their initial collection, eight fish (0.009 percent) moved between river systems, and the remaining fish (78 percent) have not yet been recaptured (NMFS and USFWS 1995). There is no information documenting the presence of spawning adults in non-natal rivers. However, there is some evidence of inter-riverine (from natal rivers into non-natal) movements by both male and female Gulf sturgeon (n=22) (Wooley and Crateau 1985; Carr et al. 1996; Craft et al. 2001; Ross et al. 2001; Fox et al. 2002).

Gene flow is low in Gulf sturgeon stocks, with each stock exchanging less than one mature female per generation (Waldman and Wirgin 1998). Genetic studies confirm that Gulf sturgeon exhibit river-specific fidelity. Stabile et al. (1996) analyzed tissue taken from Gulf sturgeon in eight drainages along the Gulf of Mexico for genetic diversity; they noted significant differences among Gulf sturgeon stocks, and suggested region-specific affinities and likely river-specific fidelity. Five regional or river-specific stocks (from west to east) have been identified: (1) Lake Pontchartrain and Pearl River, (2) Pascagoula River, (3) Escambia and Yellow Rivers, (4) Choctawhatchee River, and (5) Apalachicola, Ochlockonee, and Suwannee Rivers (Stabile et al. 1996).

Life History and Distribution

Gulf sturgeon are long-lived, with some individuals reaching at least 42 years in age (Huff 1975). Age at sexual maturity for females ranges from 8 to 17 years, and for males from 7 to 21 years (Huff 1975). Chapman and Carr (1995) estimated that mature female Gulf sturgeon weighing between 29 and 51 kilograms (kg) produce an average of 400,000 eggs. Male spawning intervals appear to range from 1 to 5 years, while females require longer intervals ranging from 3 to 5 years (Huff 1975; Fox et al. 2000).

Gulf sturgeon are anadromous fish; adults spawn in freshwater then migrate to feed and grow in estuarine/marine habitats. Gulf sturgeon move from the Gulf of Mexico into coastal rivers in early spring (i.e., March through May) when river water temperatures range from 16 to 23°C (Huff 1975; Carr 1983; Wooley and Crateau 1985; Odenkirk 1989; Clugston et al. 1995; Foster and Clugston 1997; Fox and Hightower 1998; Sulak and Clugston 1999; Fox et al. 2000). Spawning occurs in the upper river reaches in the spring when water temperature is around 15^{o} to 20^{o}C. While Sulak and Clugston (1999) suggested that sturgeon spawning activity is related to moon phase, other researchers have found little evidence of spawning associated with lunar cycles (Slack et al. 1999; Fox et al. 2000). Fertilization is external; females deposit their eggs on the river bottom and males fertilize them. Gulf sturgeon eggs are demersal, adhesive, and vary in color from gray to brown to black (Vladykov and Greely 1963; Huff 1975).

After spawning Gulf sturgeon move downstream to areas referred to as summer resting or holding areas. Adults and subadults are not distributed uniformly throughout the river, but show a preference for these discrete holding areas usually located in the lower and middle river reaches (Hightower et al. 2002). While it was suggested these “holding areas” were sought for cooler water temperatures, Hightower et al. (2002) found that water temperatures in holding areas where Gulf sturgeon were repeatedly found in the Choctawhatchee River were similar to temperatures where sturgeon were only occasionally found elsewhere in the river.

In the fall, movement from the rivers into the associated bays and estuaries begins in September (at water temperatures around 23°C) and continues through November (Huff 1975; Wooley and Crateau 1985; Foster and Clugston 1997). Because the sturgeon have spent at least six months fasting in the rivers, it is presumed they immediately begin foraging. Telemetry data indicate Gulf sturgeon are found in high concentrations near the mouths of their natal rivers with individual fish traveling relatively quickly between foraging areas where they spend an extended period of time (Edwards et al. 2003; Edwards et al. 2007).

Most subadult and adult Gulf sturgeon then spend the cool winter months (October/November through March/ April) in the bays/estuaries and the nearshore Gulf of Mexico (Odenkirk 1989; Clugston et al. 1995; Fox et al. 2002). During the winter the majority of tagged fish have been located in well-oxygenated shallower water (less than 7m) areas that support burrowing macro invertebrates (Fox and Hightower 1998; Craft et al. 2001; Parauka et al. 2001; Ross et al. 2001; Fox et al. 2002; Rogillio et al. 2007; Ross et al. 2009), in areas lacking seagrass (Parauka et al. 2001; Fox et al. 2002), in shallow shoals 1.5 to 2.1 m and deep holes near passes (Craft et al. 2001), and in unvegetated, sand habitats, such as sandbars, and intertidal and subtidal energy zones (Menzel 1971; Abele and Kim 1986; Ross et al. 2009) where they are presumed to be foraging. These shifting, predominantly sandy, areas support a variety of potential prey items including estuarine crustaceans, small bivalve mollusks, ghost shrimp, small crabs, various polychaete worms, and lancelets (Menzel 1971; Abele and Kim 1986; AFS 1989), (M. Brim, USFWS pers. comm. 2002). Preference for sandy habitat is supported by studies in other areas that have correlated Gulf sturgeon presence to sandy substrate (Fox 2002).

Gulf sturgeon have been described as opportunistic and indiscriminate benthivores that undergo ontogenetic changes in diet and foraging areas. Their guts generally contain benthic marine invertebrates including amphiopods, lancelets, polychaetes, gastropods, shrimp, isopods, molluscs, and crustaceans (Huff 1975; Mason and Clugston 1993; Carr et al. 1996; Fox et al. 2002). Generally, Gulf sturgeon prey are burrowing species that feed on detritus and/or suspended particles, and inhabit sandy substrate. Young-of-year sturgeon forage in freshwater on aquatic invertebrates and detritus (Mason and Clugston 1993; Sulak and Clugston 1999). Juveniles forage throughout the river on aquatic insects (e.g., mayflies and caddisflies), worms (oligochaete), and bivalves (Huff 1975; Mason and Clugston 1993). Adults forage sparingly in freshwater and depend almost entirely on estuarine and marine prey for their growth (Gu et al. 2001). Both adult and subadult Gulf sturgeon are known to lose up to 30 percent of their total body weight while in fresh water, and subsequently compensate the loss during winter feeding in marine areas (Carr 1983; Wooley and Crateau 1985; Clugston et al. 1995; Morrow et al. 1998; Heise et al. 1999; Sulak and Clugston 1999; Ross et al. 2000).

Published research on the life history of younger Gulf sturgeon is limited. Young-of-year individuals have been found to disperse widely downstream of spawning sites, while sometimes traveling upstream of known spawning sites (Clugston et al. 1995; Sulak and Clugston 1999), and eventually arriving in estuarine feeding areas in winter months. Sub-adult and adult Gulf sturgeon overwintering in Choctawhatchee Bay were generally found to occupy the sandy shoreline habitat at depths of 2-3 m (Parauka et al. 2001; Fox et al. 2002).

Abundance and Trends
Abundance of Gulf sturgeon is measured at the riverine scale. Gulf sturgeon abundance estimates by river and year for the seven known reproducing populations are presented in Table 4. Number of individuals within each riverine populations is variable across their range, but generally over the last decade (USFWS and NMFS 2009) populations in the eastern part of the range (Suwannee, Apalachicola Choctawhatchee) appear to be relatively stable in number or have a slightly increasing population trend. Populations in the Pearl and Pascagoula Rivers, in the western portion of the range, have never been nearly as abundant as those to the east, and their current status, post-hurricanes Katrina and Rita, is unknown as comprehensive surveys have not occurred.

Table 4. Gulf sturgeon abundance estimates by river and year, with confidence intervals (CI) for the seven known reproducing populations. Data from USFWS and NMFS 2009.

River	Year of data collection	Abundance Estimate	Lower Bound 95% CI	Upper Bound 95% CI	Source
Suwannee	2007	14,000	not reported	not reported	Sulak 2008
Apalachicola	1991	144	83	205	Zehfuss et al. 1999
Choctawhatchee	2008	3314	not reported	not reported	USFWS 2009
Yellow	2003 fall	911	550	1,550	Berg et al. 2007
Escambia	2006	451	338	656	USFWS 2007
Pascagoula	2000	216	124	429	Ross et al. 2001
Pearl	2001	430	323	605	Rogillio et al. 2001

Both acute and episodic events are known to impact individual populations of Gulf sturgeon that in turn affect overall population numbers. On August 9, 2011, an overflow of “black liquor” (an extremely alkaline waste byproduct of the paper industry) was accidentally released by a paper mill into the Pearl River near Bogalusa, LA that may affect the status and abundance of the Pearl River population. While paper mills regularly use acid to balance the black liquor’s pH before releasing the material, as permitted by the Louisiana Department of Environmental Quality, this material released was not treated. The extreme alkalinity of the untreated black liquor caused it to quickly bond with oxygen (aerobic) to dissociate in water. This reduced the amount of oxygen available within the water column, creating a hypoxic environment (< 1mg/L of dissolved oxygen) lethal to aquatic life. These hypoxic conditions moved downstream of the release site killing fish and mussels in the Pearl River over several days. Within a week after the spill, the dissolved oxygen concentrations returned to normal in all areas of the Pearl River tested by Louisiana Department of Wildlife and Fisheries (LDWF). The investigation of fish mortality began on August 13, 2011, several days after the spill occurred. Twenty-eight Gulf sturgeon carcasses (38- 168 cm TL) were collected in the Pearl River after the spill (T. Ruth, LDFW, pers. com.) and anecdotal information suggests many other Gulf sturgeon carcasses were not collected. The smaller fish collected represent young-of-the-year and indicate spawning is likely occurring in the Pearl River. The spill occurred during the time when the anadromous Gulf sturgeon was still occupying the freshwater habitat. Because the materials moved downriver after the spill, the entire Pearl River population of Gulf sturgeon was likely impacted (the Pearl River population is the western-most and likely the smallest population numbering around 300 individuals [USFWS and NMFS 2009]). Telemetry data indicated at least one adult Gulf sturgeon exited the Pearl River in front of the spill as recorded on a receiver located at the mouth of the Pearl River (G. Constant, USFWS, pers. com.). There is no other data indicating early downstream movement of the Gulf sturgeon.

Threats

The 1991 listing rule for Gulf sturgeon cited the following impacts and threats: (1) Dams on the Pearl, Alabama, and Apalachicola rivers; also on the North Bay arm of St. Andrews Bay; (2) Channel improvement and maintenance activities: dredging and de-snagging; (3) Water quality degradation, and (4) Contaminants.

In 2009 NMFS and USFWS conducted a 5-year review of the Gulf sturgeon and identified several new threats to the Gulf sturgeon (USFWS and NMFS 2009). The following is a comprehensive list of threats to Gulf sturgeon, additional details can be found in the 5-year status review (USFWS and NMFS 2009):

1) **Pollution** from industrial, agricultural, and municipal activities is believed responsible for a suite of physical, behavioral, and physiological impacts to sturgeon worldwide. Specific impacts of pollution and contamination on sturgeon have been identified to include muscle atrophy, abnormality of gonad, sperm, and egg development, morphogenesis of organs, tumors, and disruption of hormone production.
2) **Chemicals and metals** such as chlordane, DDE, DDT, dieldrin, PCBs, cadmium, mercury, and selenium settle to the river bottom and are later incorporated into the food web as they are consumed by benthic feeders, such as sturgeon or macroinvertebrates. .
3) **Bycatch** from fisheries may continue although all directed fisheries of Gulf sturgeon have been closed since 1990 (NMFS and USFWS 1995). Although confirmed reports are rare, it is a common opinion among Gulf sturgeon researchers that bycatch mortality continues.
4) **Dredging** activities can pose significant impacts to aquatic ecosystems by: (1) direct removal/burial of organisms; (2) turbidity/siltation effects; (3) contaminant re-suspension; (4) noise/disturbance; (5) alterations to hydrodynamic regime and physical habitat; and (6) loss of riparian habitat. Dredging operations may also destroy benthic feeding areas, disrupt spawning migrations, and re-suspend fine sediments causing siltation over required substrate in spawning habitat. Because Gulf sturgeon are benthic omnivores, the modification of the benthos affects the quality, quantity, and availability of prey.
5) **Collisions** between jumping Gulf sturgeon and fast-moving boats on the Suwannee River and elsewhere are a relatively recent and new source of sturgeon mortality and pose a serious public safety issue as well. The Florida Fish and Wildlife Commission documented three collisions in the Suwannee River in 2008, and one incident in 2009.
6) **Dams** represent a significant impact to Gulf sturgeon by blocking passage to historical spawning habitats, which reduces the amount of available spawning habitat or entirely impede access to it. The ongoing operations of these dams also affect downstream habitat.
7) **Global climate change** may affect Gulf sturgeon by leading to accelerated changes in habitats utilized by Gulf sturgeon through saltwater intrusion, changes in water temperature, and extreme weather periods that could increase both droughts and floods.
8) **Hurricanes** have resulted in mortality of Gulf sturgeon in both Escambia Bay after Hurricane Ivan in 2004 (USFWS 2005) and Hurricane Katrina in 2005.
9) **Red tide** is the common name for a harmful algal bloom (HAB) of marine algae (*Karenia brevis*) that produces a brevetoxin that is absorbed directly across the gill membranes of fish or through ingestion of algal cells. Fish mortalities associated with *K. brevis* events are very common and widespread. Blooms of red tides have beenin increasing in frequency in the Gulf of Mexico since the 1990’s and have likely killed Gulf sturgeon at both the juvenile and adult life stages.

10) **Aquaculture:** although the state of Florida has Best Management Practices to reduce the risk of hybridization and escapement, the threat of introduction of captive fishes into the wild continues.

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

Sea turtles
The five species of sea turtles that occur in the action area are all highly migratory. Therefore, the status of the five species (or DPS where applicable) 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).

Atlantic sturgeon
The five DPSs of Atlantic sturgeon on the East Coast of the U.S. mix extensively in marine waters (Stein et al. 2004; Erickson et al. 2011). During various seasons and portions of their life cycles, individual fish will make migrations into rivers, nearshore waters, and other areas of the North Atlantic Ocean. Adult and sub-adult (age 2 fish or older) spend a considerable portion of their lives in coastal and marine waters (Collins and Smith 1997; Stein et al. 2004; ASSRT and NMFS 2007; Laney et al. 2007; Munro et al. 2007) where they are subject to bycatch mortality by commercial fisheries (Collins et al. 1996; Armstrong and Hightower 2002; Trencia et al. 2002; Stein et al. 2004; Spear 2007), poor water quality in certain estuaries (Collins et al. 2000; Dadswell 2006) and other potential threats, such as dams, dredging, and alteration of spawning and foraging habitat (ASSRT and NMFS 2007; Munro et al. 2007). The status of the five DPSs of Atlantic sturgeon 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).

Gulf sturgeon
Gulf sturgeon are known to inhabit and forage in Gulf of Mexico nearshore estuarine and marine habitats during the winter months. There are no records of sturgeon capture in the NMFS biannual SEAMAP Trawl survey conducted in the Gulf of Mexico. Nearshore telemetry receivers indicate winter habitat for Gulf sturgeon as mostly alongshore the northern coast of Mississippi Sound extending out to the Gulf Islands. Edwards et al (2007) reported on data

collected from pop-up archival transmitting tags and found all relocations were consistent with alongshore migration and utilization of relatively shallow habitats. There are no data indicating Gulf sturgeon inhabit the deep Gulf of Mexico. NMFS believes that although the affected species occur in the action area during winter months, few, if any, Gulf sturgeon will be found in offshore federal waters. The status of Gulf sturgeon in the action area, as well as the threats to this species, is supported by the species account in Section 3 (Status of the Species).

Smalltooth sawfish
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 supported by the species account in Section 3 (Status of the Species).

4.2 Factors Affecting Sea Turtles in the Action Area

As stated in Section 2.4 (Action Area), the action area includes the Gulf and South Atlantic EEZ and adjacent marine and tidal state waters of the Gulf and South Atlantic area (i.e., from the Texas-Mexico border to the North Carolina-Virginia border). The following analysis examines the impacts of past and on-going 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 effects of the action on sea turtles. The summary below of federal actions and the effects these actions have had on sea turtles includes only those federal actions in the action areas 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, impacts have been evaluated under section 7. Formal section 7 consultations have 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:

Southeastern shrimp trawl fisheries, Atlantic HMS pelagic longline, HMS directed shark, reef fish, and coastal migratory pelagic resources fisheries. Anticipated take levels associated with these fisheries are presented in Appendix 3; 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

As described in Section 1.0 and 2.0, formal consultation has previously been conducted on Southeastern shrimp fisheries. While present and future effects of southeastern shrimp trawl fisheries is the subject of this consultation, thus not considered part of the environmental baseline, the past effects from NMFS' implantation of the sea turtle conservation regulations and authorization of federal shrimp fisheries most certainly are part of the environmental baseline. In fact, shrimp trawling is believed to have had the greatest adverse effect on sea turtles in the action area in the past.

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 Stuntz 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).

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 2002). TEDs approved for use have had to demonstrate 97 percent effectiveness in excluding sea turtles from trawls in controlled testing. Despite the apparent success of TEDs for some species of sea turtles (e.g., Kemp's ridleys), 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 for some sea turtles 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. In February 2003, NMFS implemented revisions to the TED regulations addressing that problem (68 FR 8456, February 21, 2003). The revised TED regulations were expected to reduce shrimp trawl related mortality by 94 percent for loggerheads and 97 percent for leatherbacks.

In addition to because of improvements in TED designs, interactions between sea turtles and otter trawls in the years leading up to this consultation were also thought to be declining because of reductions of fishing effort unrelated to fisheries management actions. Over the past ten years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of hurricanes in the Gulf of Mexico have all impacted shrimp fleets; in some cases reducing fishing effort by as much as 50 percent in offshore waters of the Gulf of Mexico (GMFMC 2007). For example, the estimated annual number of interactions and mortalities between sea turtles and shrimp trawls in the Gulf shrimp fisheries (state and federal) under the new regulation (68 FR 8456, February 21, 2003) based on Epperly et al. (2002) estimated CPUEs and updated 2007 effort data in Nance et al. (2008) were significantly less than predicted in the 2002 opinion

(Table 5). However, given elevated strandings in the northern Gulf of Mexico during the springs of 2010 and 2011, necropsy information indicating that drowning may have contributed to many of the mortalities, and evidence of TED compliance issues in the fisheries, these estimates likely underrepresented actual past effects from shrimp fisheries in the action area.

Table 5. Estimated annual number of interactions between sea turtles and shrimp trawls in the Gulf of Mexico shrimp fisheries 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 and kill 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 action area, fishing occurs further offshore than where shrimp trawling 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 2004). This does not account for post-release mortalities, which historically were likely substantial.

NMFS reinitiated consultation in 2003 on the pelagic longline component of this fishery as a result of exceeded incidental take levels for loggerheads and leatherbacks (NMFS 2004). The resulting opinion 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 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 three-year Northeast Distant Closed Area research experiment and other available sea turtle bycatch reduction studies, is expected to have significantly benefitted endangered and threatened sea turtles by reducing mortality attributed to this fishery.

Gulf of Mexico Reef Fish Fishery

The Gulf of Mexico reef fish fishery uses two basic types of gear: spear or powerhead, and hook-and-line gear. Hook-and-line gear used in the fishery includes both commercial bottom longline and commercial and recreational vertical line (e.g., handline, bandit gear, rod-and-reel).

Prior to 2008, the reef fish fishery was believed to have relatively moderate level of sea turtle bycatch attributed to the hook-and-line component of the fishery (i.e., approximately 107 captures and 41 mortalities annually, all species combined, for the entire fishery) (NMFS 2005) In 2008, SEFSC observer programs and subsequent analyses 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 severely exceeded by the bottom longline component of the fishery (approximately 974 captures and at least 325 mortalities estimated for the period July 2006-2007)

In response, NMFS published an emergency rule prohibiting the use of bottom longline gear in the reef fish fishery shoreward of a line approximating the 50-fathom depth contour in the eastern Gulf of Mexico, essentially closing the bottom longline sector of the reef fish fishery in the eastern Gulf of Mexico for six months pending the implementation of a long-term management strategy. The Gulf of Mexico Fishery Management Council (GMFMC) developed a long-term management strategy via a new amendment (Amendment 31 to the Reef Fish FMP). The amendment included a prohibition on the use of bottom longline gear in the Gulf of Mexico reef fish fishery, shoreward of a line approximating the 35-fathom contour east of Cape San Blas, Florida, from June through August; a reduction in the number of bottom longline vessels operating in the fishery via an endorsement program and a restriction on the total number of hooks that may be possessed onboard each Gulf of Mexico reef fish bottom longline vessel to 1,000, only 750 of which may be rigged for fishing.

On October 13, 2009, SERO completed an opinion that analyzed the expected effects of the continued operation of the Gulf of Mexico reef fish fishery under the changes proposed in Amendment 31 (NMFS-SEFSC 2009b). The opinion concluded that sea turtle takes would be substantially reduced compared to the fishery as it was previously prosecuted, and that operation of the fishery would not jeopardize the continued existence of any sea turtle species. Amendment 31 was implemented on May 26, 2010. In August 2011, consultation was reinitiated to address the DWH oil release event and potential changes to the environmental baseline. Reinitiation of consultation was not related to any material change in the fishery itself, violations of any terms and conditions of the 2009 opinion, or an exceedance of the incidental take statement. The resulting September 11, 2011 opinion concluded the continued operation of the Gulf reef fish fishery is not likely to jeopardize the continued existence of any listed sea turtles.

South Atlantic Snapper-Grouper Fishery
The South Atlantic snapper-grouper fishery uses spear and powerheads, black sea bass pots, and hook-and-line gear. Hook-and-line gear used in the fishery includes commercial bottom longline gear and commercial and recreational vertical line gear (i.e., handline, bandit gear, and rod-and-reel). The most recent consultation was completed in 2006 (NMFS 2006) and found only hook-and-line gear likely to adversely affect, green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. The consultation concluded the proposed action was not likely to jeopardize the continued existence of any of these species, and an ITS was provided.

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 t 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, small coastal sharks, 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 was generally open for the first three months of the year and then a few weeks in July/August.

Observation of directed HMS shark fisheries has 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 2003).

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. Vessels fishing outside of the research fishery have 5 to 8 percent observer coverage, and no sea turtles have been observed to date.

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 2007). 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. A winter troll fishery operates along the east and south Gulf coast. 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 2007). 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.

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 2009)]. 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, only traps are expected to result in adverse effects on sea turtles. 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. Fishing activity is limited to waters off south 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).

Stone Crab Fishery
NMFS completed a section 7 consultation on the Gulf of Mexico Stone Crab FMP on September 28, 2009 (NMFS 2009). The commercial component of the fishery is traps; recreational fishers use traps or wade/dive for stone crabs. Of the gears used, only commercial traps are expected to result in adverse effects on ESA-listed species. The number of commercial traps actually in the water is very difficult to estimate, and the number of traps used recreationally is unquantifiable with any degree of accuracy. The consultation determined the continued authorization of the fishery would not adversely affect ESA-listed marine mammals, Gulf sturgeon, or adversely affect critical habitat. It did conclude the action was likely to adversely affect sea turtles and smalltooth sawfish, but would not jeopardize their continued existence; an ITS was issued for takes in the commercial trap sector of the fishery. On October 28, 2011, NMFS repealed the federal FMP for this fishery, and the fishery is now managed exclusively by the state of Florida.

Dolphin/Wahoo Fishery
The South Atlantic FMP for the dolphin/wahoo fishery was approved in December 2003. The stated purpose of the Dolphin and Wahoo FMP is to adopt precautionary management strategies to maintain the current harvest level and historical allocations of dolphin (90 percent recreational) and ensure no new fisheries develop. At that time, HMS pelagic logline vessels were also fishing for dolphin using small hooks attached to their surface buoys. NMFS conducted a formal section 7 consultation to consider the effects on sea turtles of authorizing fishing under the FMP (NMFS 2003). The August 27, 2003, opinion concluded that green, hawksbill, Kemp’s ridley, leatherback, and loggerhead sea turtles may be adversely affected by the longline component of the fishery, but it was not expected to jeopardize their continued existence. An ITS for sea turtles was provided with the opinion. Pelagic longline vessels can no longer target dolphin/wahoo with smaller hooks because of hook size requirements in the pelagic longline fishery, thus little longline effort targeting dolphin is currently believed to be present in the action area.

4.2.1.2 Federal Vessel Activity and Military Operations

Watercraft are the greatest contributors to overall noise in the sea and have the potential to interact with sea turtles though direct impacts or propellers. Sound levels and tones produced are generally related to vessel size and speed. Larger vessels generally emit more sound than smaller vessels, and vessels underway with a full load, or those pushing or towing a load, are noisier than unladen vessels. Vessels operating at high speeds have the potential to strike sea turtles. Potential sources of adverse effects from federal vessel operations in the action area include operations of the U.S. Department of Defense (DoD), BOEM/BSEE, FERC, USCG, NOAA, and COE.

Military
Formal consultations on overall USN activities in the Atlantic have been completed, including U.S. Navy's Activities in East Coast Training Ranges (June 1, 2011): U.S. Navy Atlantic Fleet Sonar Training Activities (AFAST) (January 20, 2011); Navy AFAST LOA 2012-2014: U.S. Navy active sonar training along the Atlantic Coast and Gulf of Mexico (December 19, 2011); Activities in GOMEX Range Complex from November 2010 to November 2015 (March 17 2011); and Navy's East Coast Training Ranges (Virginia Capes, Cherry Point, and Jacksonville) (June 2010). These opinions concluded that although there is a potential from some USN activities to effect sea turtles, those effects were not expected to impact any species on a population level. Therefore, the activities were determined to be not likely to jeopardize the continued existence of any ESA-listed sea turtle species.

Military testing and training may also affect listed species of sea turtles. The air space over the GOM is used extensively by the DoD for conducting various air-to-air and air-to-surface operations. Nine military warning areas and five water test areas are located within the GOM. The western GOM has four warning areas that are used for military operations. The areas total approximately 21 million acres (ac) or 58% of the area. In addition, six blocks in the western GOM are used by the Navy for mine warfare testing and training. The central GOM has five designated military warning areas that are used for military operations. These areas total approximately 11.3 million ac. Portions of the Eglin Water Test Areas (EWTA) comprise an additional 0.5 million ac in the Central Planning Area (CPA). The total 11.8 million ac is about 25% of the area of the CPA.

A consultation evaluating the impacts from USAF search-and-rescue training operations in the Gulf of Mexico was completed in 1999 (NMFS 1999d). NMFS more recently completed four consultation on Eglin Air Force Base testing and training activities in the GOM. These consultations concluded that the incidental take of sea turtles is likely to occur. These opinions have issued incidental take for these actions: Eglin Gulf Test and Training Range (NMFS 2004), the Precision Strike Weapons Tests (NMFS 2005), the Santa Rosa Island Mission Utilization Plan (NMFS 2005) and Naval Explosive Ordnance Disposal School (NMFS 2004). These consultations determined the training operations would adversely affect sea turtles but would not jeopardize their continued existence.

Offshore Energy
NMFS has also conducted section 7 consultations related to energy projects in the Gulf of Mexico (Mineral Management Service, FERC, and MARAD) to implement conservation measures for vessel operations. Through the section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. However, at the present time they present the potential for some level of interaction.

Dredging

Marine dredging vessels are common within U.S. coastal waters. Although the underwater noises from dredge vessels are typically continuous in duration (for periods of days or weeks at a time) and strongest at low frequencies, they are not believed to have any long-term effect on sea turtles. However, the construction and maintenance of federal navigation channels and dredging in sand mining sites ("borrow areas") have been identified as sources of sea turtle mortality. Hopper dredges in the dredging mode are capable of moving relatively quickly compared to sea turtle swimming speed and can thus overtake, entrain, and kill sea turtles as the suction draghead(s) of the advancing dredge overtakes the resting or swimming turtle. Entrained sea turtles rarely survive. NMFS completed regional opinions on the impacts of COE's hopper-dredging operation in 1997 for dredging along the South Atlantic (NMFS 1997)and in 2003 for operations in the Gulf of Mexico (NMFS 2007). In the Gulf of Mexico regional opinion, NMFS determined that (1) Gulf of Mexico hopper dredging would adversely affect Gulf sturgeon and four sea turtle species (i.e., green, hawksbill, Kemp's ridley, and loggerheads) but would not jeopardize their continued existence and (2) dredging in the Gulf of Mexico would not adversely affect leatherback sea turtles, smalltooth sawfish, or ESA-listed large whales. An ITS for those species adversely affected was issued. In the South Atlantic regional opinion, NMFS determined that (1) hopper dredging in the South Atlantic would adversely affect shortnose sturgeon and four sea turtle species (i.e., green, hawksbill, Kemp's ridley, and loggerheads), but would not jeopardize their continued existence, and (2) South Atlantic dredging would not adversely affect leatherback sea turtles or ESA-listed large whales. An ITS for those species adversely affected was issued.

The above-listed regional opinions consider maintenance dredging and sand mining operations. Numerous other "free-standing" opinions have been produced that analyzed hopper dredging projects that did not fall (partially or entirely) under the scope of actions contemplated by these regional opinions. For example, in the Gulf of Mexico, in 1998 the Houston-Galveston Navigation Channel dredging project was a major port improvement dredging project that was consulted on separately from the then-existing 1995 Gulf of Mexico regional opinion on "maintenance" hopper dredging (the predecessor of the 2003 GRBO. Numerous other opinions have been issued in the Gulf of Mexico since 2003, covering navigation channel improvements and beach restoration projects, including: dredging of Ship Shoal in the Gulf of Mexico Central Planning Area for coastal restoration projects [opinion issued to MMS, now BOEM, in 2005 (NMFS 2005)], Gulfport Harbor Navigation Project [to COE in 2007 (NMFS 2007)], East Pass dredging, Destin, Florida [to COE in 2009 (NMFS 2009)], Mississippi Coastal Improvements Program (federal restoration project) dredging and disposal of sand along Ship Island barrier island [to COE in 2010 (NMFS 2010)], and dredging of City of Mexico beach canal inlet [to COE in 2012 (NMFS 2012)]. Similarly, in the South Atlantic, opinions issued for dredging and beach nourishment projects outside the scope of the SARBO included: Savannah Harbor Federal Navigation Project (channel widening and deepening for Post-Panamax vessels) [2011 opinion to COE (NMFS 2011)], use of Canaveral Shoals borrow area for a beach renourishment and protection project at Patrick Air Force Base, Cocoa Beach, Florida [2010 opinion to USAF (NMFS 2010)], channel dredging for homeporting of carrier group surface ships at U.S. Naval Station Mayport [opinion issued to USN in 2009 (NMFS 2009)], and Boca Raton Inlet Dredging Project [opinion to COE, 2008 (NMFS 2008)], among others. Each of the above free-standing opinions had its own ITS and determined that hopper dredging during the proposed action would not adversely affect any species of sea turtles or other listed species, or destroy or adversely modify critical habitat of any listed species.

Recreational Boat Traffic
Data show that vessel traffic is one cause of sea turtle mortality (Lutcavage et al. 1997), Sea Turtle Stranding Database). Stranding data for the U.S. GOM and Atlantic coasts show that vessel-related injuries are noted in stranded sea turtles. Data indicate that live- and dead-stranded sea turtles showing signs of vessel-related injuries continue in a high percentage of stranded sea turtles in coastal regions of the southeastern United States. Although the COE-permitted docks and boats may determine the location of recreational vessels, for most projects, the docks themselves are not believed to result in increases of the number recreational vessels on the water.

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.

4.2.1.3 Oil and Gas Exploration and Extraction

Federal and state oil and gas exploration, production, and development are expected to result in some sublethal effects to protected species, 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 opinions concluded only one sea turtle take may occur annually due to vessel strikes. Opinions issued on July 11, 2002 (NMFS 2002), November 29, 2002 (NMFS 2002), August 30, 2003 [Lease Sales 189 and 197, (NMFS 2003)], and June 29, 2007 [2007-2012 Five-Year Lease Plan, NMFS 2007b (NMFS 2007)] have concluded that sea turtle takes may also result from vessel strikes, marine debris, and oil spills.

Explosive removal of offshore structures and seismic exploration may adversely affect sea turtles. In July 2004, MMS completed a programmatic environmental assessment (PEA) on geological and geophysical exploration on the GOM Outer Continental Shelf (OCS). In an August 28, 2006 opinion, NMFS issued incidental take for MMS-permitted explosive structure removals (NMFS 2006). On April 18, 2011, NMFS received a revised complete application from the MMS (now the Bureau of Ocean Energy Management (BOEM) requesting an authorization for the take of marine mammals incidental to seismic surveys on the OCS in the GOM (see 76 FR 34,656, June 14, 2011). NMFS intends to conduct a programmatic consultation with BOEM prior to issuing the requested MMPA authorization that will consider the effects to listed sea turtles for BOEM-authorized seismic activities throughout the northern Gulf of Mexico.

NMFS' June 29, 2007, opinion issued to MMS concluded that the five-year leasing program for oil and gas development in the coastal and the Western Planning Areas of the Gulf of Mexico. and its associated actions were not likely to jeopardize the continued existence of threatened or endangered species or destroy or adversely modify designated critical habitat. NMFS estimated the number of listed species that could potentially experience adverse effects as the result of exposure to an oil spill over the lifetime of the action. However, as discussed below, on April 20, 2010, a massive oil well explosion, and then subsequent release of oil at the DWH MC252 well occurred. Given the effects of the spill, on July 30, 2010, BOEM requested reinitiation of interagency consultation under section 7 of the ESA on the June 29, 2007, opinion on the Five-Year Outer Continental Shelf Oil and Gas Leasing Program (2007-2012) in the Central and Western Planning Areas of the Gulf of Mexico.

NMFS has begun synthesizing data from the spill, and it is clear that MMS underestimated the size, frequency, and impacts associated with a catastrophic spill under the 2007-2012 lease sale program. The size and duration of the DWH oil spill were greater than anticipated, and the effects on listed species have exceeded NMFS' projections. However, NMFS has not yet issued a opinion concluding the reinitiated consultation.

The DWH Oil Spill and Recent Increase in Sea Turtle Strandings in the Northern Gulf

On April 20, 2010, while working on an exploratory well approximately 50 miles offshore Louisiana, the semi-submersible drilling rig DWH experienced an explosion and fire. The rig subsequently sank and oil and natural gas began leaking into the Gulf of Mexico. Oil flowed for 86 days, until finally being capped on July 15, 2010. Official estimates are that just under 5 million barrels of oil were released into the Gulf, with some experts estimating even higher volumes. Additionally, approximately 1.84 million gallons of chemical dispersant was applied both subsurface and on the surface to attempt to break down the oil. There is no question that the unprecedented DWH spill and associated response activities (e.g., skimming, burning, and application of dispersants) have resulted in adverse effects on listed sea turtles. Smalltooth sawfish may also be adversely affected by oil, but at this time there is no evidence documenting effects on smalltooth sawfish from this particular oil spill.

At this time, the total effects of the oil spill on species found throughout the Gulf of Mexico, including sea turtles, are not known. Potential DWH-related impacts to all sea turtle species include direct oiling or contact with dispersants from surface and subsurface oil and dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is currently an ongoing investigation and analysis being conducted under the Oil Pollution Act (33 U.S.C. 2701 *et seq*.) to assess natural resource damages and to develop and implement a plan for the restoration, rehabilitation, replacement or acquisition of the equivalent of the injured natural resources. The final outcome of that investigation may not be known for many months to years from the time of this opinion. Consequently, other than some emergency restoration efforts, most restoration efforts that occur pursuant to the Oil Pollution Act have yet to be determined and implemented, and so the ultimate restoration impacts on the species are unknowable at this time. However, despite the lack of solid information on the population level impacts to sea turtles, if any, we must attempt a reasonable assessment of what those impacts may be based upon the limited available information, knowledge of the species involved, and best professional scientific judgment. This is needed in order to analyze how the continuation implementation of the sea turtle conservation regulations and the continued authorization of federal shrimp fisheries would impact sea turtle species in light of the possible environmental baseline effects from the DWH event.

During the response phase to the DWH oil spill (April 26 – October 20, 2010) a total of 1,146 sea turtles were recovered, either as strandings (dead or debilitated generally onshore or nearshore) or were collected offshore during sea turtle search and rescue operations (Table 6). Subsequent to the response phase a few sea turtles with visible evidence of oiling have been recovered as strandings. The available data on sea turtle strandings and response collections during the time of the spill are expected to represent a fraction (currently unknown) of the actual losses to the species, as most individuals likely were not recovered. The number of strandings does not provide insights into potential sub-lethal impacts that could reduce long-term survival or fecundity of individuals affected. However, it does provide some insight into the potential relative scope of the impact among the sea turtle species in the area. Kemp's ridley sea turtles may have been the most affected sea turtle species, as they accounted for almost 71 percent of all recovered turtles (alive and dead), and 79 percent of all dead turtles recovered. Green turtles accounted for 17.5 percent of all recoveries (alive and dead), and 4.8 percent of the dead turtles recovered. Loggerheads comprised 7.7 percent of total recoveries (alive and dead) and 11 percent of the dead turtle recovered. The remaining turtles were hawksbills and decomposed hardshell turtles that were not identified to species. No leatherbacks were among the sea turtles recovered in the spill response area. (Note: leatherbacks were documented in the spill area, but they were not recovered alive or dead).

Table 6. Sea Turtles Recovered in the DWH Spill Response Area (April 26 – October 20, 2010).

Turtle Species	Alive	Dead	Total
Green turtle (*Chelonia mydas*)	172	29	201
Hawksbill turtle (*Eretmochelys imbricata*)	16	0	16
Kemp's ridley turtle (*Lepidochelys kempii*)	328	481	809
Loggerhead turtle (*Caretta caretta*)	21	67	88
Unknown turtle species	0	32	32
Total	537	609	1146

(http://www.nmfs.noaa.gov/pr/health/oilspill/turtles.htm)

Although extraordinarily high numbers of threatened and endangered sea turtles were documented stranded (primarily within Mississippi Sound), during the DWH oil spill the vast majority of sea turtles recovered by the stranding network have shown no visible signs of oil. The oil spill increased awareness and human presence in the northern Gulf of Mexico, which likely resulted in some of the increased reporting of stranded turtles to the stranding network. However, we do not believe this factor fully explains the increases observed in 2010. We believe some of the increases in strandings may also be attributed to bycatch mortality in the shrimp fishery. As a result, as discussed previously, on August 16, 2010, NMFS reinitiated section 7 consultation on southeastern state and federal shrimp fisheries based on a high level of strandings, elevated nearshore sea turtle abundance as measured by trawl catch per unit of effort, and lack of compliance with TED requirements. These factors indicated sea turtles may be affected by shrimp trawling to an extent not previously considered in the 2002 shrimp opinion.

Another period of high stranding levels occurred in 2011, similar to that in 2010. Investigations, including necropsies, were undertaken by NMFS to attempt to determine the cause of those strandings. Based on the findings, the two primary considerations for the cause of death of the turtles that were necropsied are forced submergence or acute toxicosis. With regard to acute toxicosis, sea turtle tissue samples were tested for biotoxins of concern in the northern Gulf of Mexico. Environmental information did not indicate a harmful algal bloom of threat to marine animal health was present in the area. With regard to forced submergence, the only known plausible cause of forced submergence that could explain this event is incidental capture in fishing gear. NMFS has assembled information regarding fisheries operating in the area during and just prior to these strandings. While there is some indication that lack of compliance with existing TED regulations and the operations of other trawl fisheries that do not require TEDs may have occurred in the area at the time of the strandings, direct evidence that those events caused the unusual level of strandings is not available. More information on the stranding event, including number of strandings, locations, and species affected, can be found at http://www.nmfs.noaa.gov/pr/species/turtles/gulfofmexico.htm.

In addition to effects on subadult and adult sea turtles, the 2010 May through September sea turtle nesting season in the northern Gulf may also have been adversely affected by the DWH oil spill. Setting booms to protect beaches, cleanup activities, lights, people, and equipment all may have had unintended effects, such as preventing females from reaching nesting beaches and thereby reducing nesting in the northern Gulf.

The oil spill may also have adversely affected emergence success. In the northern Gulf area, approximately 700 nests are laid annually in the Florida Panhandle and up to 80 nests are laid annually in Alabama. Most nests are made by loggerhead sea turtles; however, a few Kemp's ridley and green turtle nests were also documented in 2010. Hatchlings begin emerging from nests in early to mid-July, the number of hatchlings estimated to be produced from northern Gulf sea turtle nests in 2010 was 50,000. To try to avoid the loss of most, if not all, of 2010's northern Gulf of Mexico hatchling cohort, all sea turtle nests laid along the northern Gulf coast were visibly marked to ensure that nests were not harmed during oil spill cleanup operations that are undertaken on beaches. In addition, a sea turtle late-term nest collection and hatchling release plan was implemented to provide the best possible protection for sea turtle hatchlings emerging from nests in Alabama and the Florida Panhandle. Starting in June, northern Gulf nests were relocated to the Atlantic to provide the highest probability of reducing the anticipated risks to hatchlings as a result of the DWH oil spill. A total of 274 nests, all loggerheads except for 4 green turtle and 5 Kemp's ridley nests, were translocated just prior to emergence from northern Gulf of Mexico beaches to the east coast of Florida so that the hatchlings could be released in areas not affected by the oil spill (Table 7). In mid-August, it was determined that the risks to hatchlings emerging from beaches and entering waters off the northern Gulf coasts had diminished significantly and all nest translocations were ceased by August 19, 2010.

Table 7. Number of turtle nests translocated from the Gulf coast and hatchlings released in the Atlantic Ocean. The sea turtle nest translocation effort ceased on August 19, 2010.

Turtle Species	Translocated Nests	Hatchlings Released
Green turtle (*Chelonia mydas*)	4	455
Kemp's ridley turtle (*Lepidochelys kempii*)	5	125
Loggerhead turtle (*Caretta caretta*)	265*	14,216

*Does not include one nest that included a single hatchling and no eggs.
(http://www.nmfs.noaa.gov/pr/health/oilspill/turtles.htm)

The survivorship and future nesting success of individuals from one nesting beach being transported to and released at another nesting beach is unknown. The loggerheads nesting and emerging from nests in the Florida Panhandle and Alabama are part of the Northern Gulf of Mexico Recovery Unit (NGMRU) and differ genetically from loggerheads produced along the Atlantic Coast of Florida, but they are part of Northwest Atlantic Ocean DPS. Evidence suggests that some portion of loggerheads produced on Northern Gulf beaches are transported naturally into the Atlantic by currents and spend portions of their life cycle away from the Gulf of Mexico. This is based on the presence of some loggerheads with a northern Gulf of Mexico genetic signature in the Atlantic. These turtles are assumed to make their way back to the Gulf of Mexico as subadults and adults. It is unknown what the impact of the nesting relocation efforts will be on the NGMRU in particular, or the Northwest Atlantic DPS generally.

Loggerhead nesting in the northern Gulf of Mexico represents a small proportion of overall Florida loggerhead nesting and an even smaller proportion of the Northwest Atlantic Ocean DPS. The five-year average (2006-2010) for the statewide number of loggerhead nests in the state of Florida is 56,483 nests annually (Florida Fish and Wildlife Conservation Commission nesting database) versus an average of well under 1,000 nests per year for the northern Gulf of Mexico (approximately 700 in 2010). As previously stated, we do not know what the impact of relocating 265 nests will be on the 2010 nesting cohort compared to the total of approximately 700 nests laid on Northern Gulf beaches. While there may be a risk of possible increased gene flow across loggerhead recovery units, all are within the Northwest Atlantic Ocean DPS and would likely not be on a scale of conservation concern. However, recovery units are subunits of the listed species that are geographically or otherwise identifiable and essential to the recovery of the species. Recovery units are individually necessary to conserve genetic robustness, demographic robustness, important life history stages, or some other feature necessary for long-term sustainability of the species. Recovery units are not necessarily self-sustaining viable units on their own, but instead need to be collectively recovered to ensure recovery of the entire listed entity. Recovery criteria must be met for all recovery units identified in the Recovery Plan before the Northwest Atlantic DPS can be considered for delisting.

As noted earlier, the vast majority of sea turtles collected in relation to the DWH oil release were Kemp’s ridleys; 328 were recovered alive and 481 were recovered dead. We expect that additional mortalities occurred that were undetected and are, therefore, currently unknown. It is likely that the Kemp’s ridley sea turtle was also the species most impacted by the DWH event on a population level. Relative to the other species, Kemp’s ridley populations are much smaller, yet recoveries during the DWH oil spill response were much higher. The location and timing of the DWH event were also important factors. Although significant assemblages of juvenile Kemp's ridleys occur along the U.S. Atlantic coast, Kemp's ridley sea turtles use the Gulf of Mexico as their primary habitat for most life stages, including all of the mating and nesting. As a result, all mating and nesting adults in the population necessarily spend significant time in the Gulf of Mexico, as do all hatchlings as they leave the beach and enter the pelagic environment. However, not all of those individuals will have encountered oil and/or dispersants, depending on the timing and location of their movements relative to the location of the subsurface and surface oil. In addition to mortalities, the effects of the spill may have included disruptions to foraging and resource availability, migrations, and other unknown effects as the spill began in late April just before peak mating/nesting season (May-July) although the distance from the MC252 well to the primary mating and nesting areas in Tamaulipas, Mexico greatly reduces the chance of these disruptions to adults breeding in 2010. However, turtle returns from nesting beaches to foraging areas in the northern Gulf of Mexico occurred while the well was still spilling oil. At this time we cannot determine the specific reasons accounting for year-to-year fluctuations in numbers of Kemp's ridley nests (the number of nests increased in 2011 as compared to 2010); however, there may yet be long-term population impacts resulting from the oil spill. How quickly the species returns to the previous fast pace of recovery may depend in part on how much of an impact the DWH event has had on Kemp's ridley food resources (Crowder and Heppell 2011).

Eighty-eight loggerhead sea turtles have been documented within the designated spill area as part of the response efforts; 67 were dead and 21 were alive. It is unclear how many of those without direct evidence of oil were actually impacted by the spill and spill-related activities versus other sources of mortality. There were likely additional mortalities that were undetected and, therefore, currently unknown. Although we believe that the DWH event had adverse effects on loggerheads, the population level effect was not likely as severe as it was for Kemp's ridleys. In comparison to Kemp's ridleys, we believe the relative proportion of the population exposed to the effects of the event was much smaller, the number of turtles recovered (alive and dead) are fewer in absolute numbers, and the overall population size is believed to be many times larger. Additionally, unlike Kemp's ridleys, the majority of nesting for the Northwest Atlantic Ocean loggerhead DPS occurs on the Atlantic coast. However, it is likely that impacts to the Northern Gulf of Mexico Recovery Unit of the NWA loggerhead DPS would be proportionally much greater than the impacts occurring to other recovery units because of impacts to nesting (as described above) and a larger proportion of the NGMRU recovery unit, especially mating and nesting adults, being exposed to the spill. However, the impacts to that recovery unit, and the possible effect of such a disproportionate impact on that small recovery unit to the NWA DPS and the species, remain unknown.

Green sea turtles comprised the second-most common species recovered as part of the DWH response. Of the 201 green turtles recovered 29 were found dead or later died while undergoing rehabilitation. The mortality number is lower than that for loggerheads despite loggerheads having far fewer total strandings, but this is because the majority of green turtles came from the offshore rescue (pelagic stage), of which almost all (of all species) survived after rescue, whereas a greater proportion of the loggerhead recoveries were nearshore neritic stage individuals found dead. While green turtles regularly use the northern Gulf of Mexico, they have a widespread distribution throughout the entire Gulf of Mexico, Caribbean, and Atlantic. As described in the

Status of the Species section, nesting is relatively rare on the northern Gulf coast. Therefore, similar to loggerhead sea turtles, while it is expected that adverse impacts occurred, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event, and thus the population-level impact, is likely much smaller than for Kemp's ridleys.

Currently available information indicates hawksbill and leatherback sea turtles were least affected, at least directly, by the oil spill. Sixteen hawksbills (all alive) were recovered (all alive) during the response phase for the DWH spill. Based on information collected during the response, oceanic stage juvenile hawksbills use the offshore waters of the northern Gulf of Mexico, but overall they are proportionally fewer in number than the other species discussed above. Hawksbill nesting in the northern Gulf of Mexico is a very rare event. Leatherbacks rarely nest along the Gulf coast, but do use the offshore waters. Potential DWH-related impacts to leatherback sea turtles include direct oiling or contact with dispersants from surface and subsurface oil and dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

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. 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. 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 State Fisheries

Various fishing methods used in state commercial and recreational fisheries, including gillnets, fly nets, trawling, pot fisheries, pound nets, and vertical line are all known to incidentally take sea turtles, but information on these fisheries is sparse (NMFS-SEFSC 2001). Most of the state data are based on extremely low observer coverage, or sea turtles were not part of data collection; thus, these data provide insight into gear interactions that could occur but are not indicative of the magnitude of the overall problem.

Gillnet Fisheries
A detailed summary of the gillnet fisheries currently operating along the mid- and southeast U.S. Atlantic coastline, and Gulf of Mexico, which are known to incidentally capture loggerheads, can be found in the TEWG reports (1998; 2000). Georgia and South Carolina prohibit gillnets for all but the shad fishery. No adverse effects to sea turtles or any other protected species group were observed during the one season the NMFS SEFSC observed this fishery in South Carolina (McFee et al. 1996). Florida has banned all but very small nets in state waters, as has Texas. Louisiana, Mississippi, and Alabama have also placed restrictions on gillnet fisheries within state waters such that very little commercial gillnetting takes place in Southeast waters, with the exception of North Carolina. Some illegal gillnet incidental captures have been reported in South Carolina, Florida, Louisiana, and Texas (NMFS-SEFSC 2001).

Gillnetting is more prevalent in North Carolina state waters. Incidental captures in gillnet fisheries (both lethal and non-lethal) of loggerhead, leatherback, green and Kemp's ridley sea turtles have been reported (W. Teas, pers. comm.; J. Braun-McNeill, pers. comm.). For example, gillnetting activities in North Carolina associated with the southern flounder fishery had been implicated in large numbers of sea turtle mortalities. The Pamlico Sound portion of that fishery was closed and has subsequently been reopened under section 10(a)(1)(B) permits. Since 2006, the observed and estimated sea turtle interactions with Pamlico Sound gillnet fishing activates have increased significantly. As a result, the gillnet fishing season has closed early for several years to ensure that take levels of authorized under the section 10(a)(1)(B) permit are not exceeded. North Carolina is now in the process of applying for a section 10(a)(1)(B) permit for all inshore state gillnetting. In the interim, they have adopted a number of gillnet fishery requirements to reduce the take and mortality of sea turtles per a May 13, 2010, settlement agreement with the Karen Beasely Sea Turtle Rescue and Rehabilitation Center which had sued the state over gillnet interactions with sea turtles.

Trawl Fisheries
In North Carolina, a high opening bottom trawl locally known as a “flynet” is used to target Atlantic croaker and weakfish. The North Carolina Observer program documented 33 flynet trawl trips from November through April of 1991-1994 and recorded no sea turtles caught in 218 hours of trawl effort. However, in 1994, NMFS’ Northeast Fisheries Observer Program (NEFOP) documented sea turtle bycatch in the Atlantic croaker and weakfish trawl fishery off North Carolina. During nine tows targeting Atlantic croaker, a flynet without a TED took seven loggerheads. On a previous trip, the same vessel took 12 loggerheads in 11 out of 13 observed flynet tows. In 1998, the SEFSC began developing a TED for flynets. In 2007, the Flexible Flatbar Flynet (FFF) TED was developed for the fishery and catch retention trials and usability testing was completed (Gearhart 2010).

Another state bottom trawl fisheries that is suspected of incidentally capturing sea turtles is the whelk trawl fishery in South Carolina (S. Murphy, pers. comm. to J. Braun-McNeill, SEFSC, November 27, 2000) and Georgia (M. Dodd, GADNR, pers. comm. to J. Braun-McNeill, December 21, 2000). In South Carolina, the whelk trawling season opens in late winter and early spring when offshore bottom waters are <55ºF. One criterion for closure of this fishery is water temperature: whelk trawling closes for the season and does not reopen throughout the state until six days after water temperatures first reach 64ºF in the Fort Johnson boat slip. Based on the SCDNR Office of Fisheries Management data, approximately six days will usually lapse before water temperatures reach 68ºF, the temperature at which sea turtles move into state waters (D. Cupka, pers. comm.). From 1996-1997, observers onboard whelk trawlers in Georgia reported a total of three Kemp's ridley, two green, and two loggerhead sea turtles captured in 28 tows for a CPUE of 0.3097 sea turtles/100 ft net hour. Since December 2000, TEDs have been required in Georgia state waters when trawling for whelk. There has also been one report of a loggerhead captured in a Florida try net (W. Teas, pers. comm.). Trawls for cannonball jellyfish may also be a source of interactions.

On February 15, 2007, NMFS published an advanced notice of proposed rulemaking (ANPR) regarding potential amendments to the regulatory requirements for TEDs (72 FR 7382). The proposed changes include increasing the size of the TED escape opening currently required in the summer flounder fishery; requiring the use of TEDs in the flynet, whelk, calico scallop, and Mid-Atlantic sea scallop trawl fisheries; and moving the current northern boundary of the Summer Flounder Fishery-Sea Turtle Protection Area off Cape Charles, Virginia, to a point farther north. The objective of the proposed measures would be to effectively protect all life stages and species of sea turtle in Atlantic and Gulf of Mexico trawl fisheries where they are vulnerable to incidental capture and mortality. On July 24, 2011, NMFS published a proposed rule stating its intent to prepare an EIS and conduct public scoping meetings regarding potential amendments to the regulatory requirements for TEDs (75 FR 37050). Scoping meetings were held from July 12-18, 2011, in Louisiana, Mississippi, Alabama, and North Carolina. To date, NMFS has not released a DEIS.

Trap Fisheries

Another potential state fishery impact to loggerheads and other sea turtles is via entanglement in trap fisheries. Although no incidental captures have been documented from fish traps set in North Carolina and Delaware (Anonymous 1995), the incidental captures of loggerheads and leatherbacks in fish traps set in Massachusetts, Rhode Island, New York, New Jersey, and Maryland have been reported (W. Teas, pers. comm.).

Fixed Net Fisheries

Stationary pound net gear is known to incidentally capture loggerhead sea turtles in North Carolina (Epperly et al. 2000). Although pound nets are not a significant source of mortality for loggerheads in North Carolina (Epperly et al. 2000), they have been implicated in the stranding deaths of loggerheads in the Chesapeake Bay from mid-May through early June (Bellmund et al. 1987). The sea turtles were reported entangled in the large mesh (>8 inches) pound net leads (NMFS-SEFSC 2001).

The fishing activities discussed above may be correlated to regular pulses of greatly elevated sea turtle strandings along North Carolina in the late fall/early spring, coincident with their migrations. For example, in the last weeks of April through early May 2000, approximately 300 sea turtles, mostly loggerheads, stranded north of Oregon Inlet, North Carolina. Gillnets were found with four of the carcasses. These strandings were likely caused by state fisheries as well as federal fisheries, although not any one fishery has been identified as the major cause. Fishing effort data indicate that fisheries targeting monkfish, dogfish, and bluefish were operating in the area of the strandings. Strandings in this area represent, at best, 7-13 percent of the actual nearshore mortality (Epperly et al. 1996). Studies by Bass et al. (1998), Norrgard (1995) and Rankin-Baransky (1997) indicate that the percentage of northern loggerheads in this area is highly over-represented in the strandings when compared to the ca. 9 percent representation from this subpopulation in the overall U.S. sea turtle nesting populations. Specifically, the genetic composition of sea turtles in this area is 25-54 percent from the northern subpopulation, 46-64 percent from the South Florida sub-population, and 3-16 percent from the Yucatan subpopulation. The cumulative removal of these sea turtles on an annual basis could potentially severely impact the northern subpopulation and leave it vulnerable to extirpation. The loss of genetic diversity as a result of distinct nesting aggregations would severely impede the recovery of this species.

Beyond commercial fisheries, observations of state recreational fisheries have shown that loggerhead, leatherback, Kemp's ridley, and green sea turtles are known to bite baited hooks, and loggerheads and Kemp's ridleys frequently ingest the hooks. Data reported through MRFSS (STSSN) show recreational fishers have hooked sea turtles when fishing from boats, piers, and beach, banks, and jetties.

Although few of these state regulated fisheries are currently authorized to incidentally take listed species, several state agencies have approached NMFS to discuss applications for a section 10(a)(1)(B) incidental take permit. Since NMFS' issuance of a section 10(a)(1)(B) permit requires formal consultation under section 7 of the ESA, any fisheries that come under a section 10(a)(1)(B) permit in the future will likewise be subject to section 7 consultation. Although the past and current effects of these fisheries on listed species are currently not determinable, NMFS believes that ongoing state fishing activities may be responsible for seasonally high levels of observed strandings of sea turtles on both the Atlantic and Gulf of Mexico coasts.

4.2.2.2 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 and Environmental Contamination

Sources of pollutants along the action area include atmospheric loading of pollutants such as PCBs, stormwater runoff from coastal towns and cities into rivers and canals emptying into bays and the ocean (e.g., Mississippi River into the Gulf of Mexico), and groundwater and other discharges. Nutrient loading from land-based sources such as coastal community discharges is known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. Although pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo et al. 1986), the impacts of many other anthropogenic toxins have not been investigated.

Coastal runoff, marina and dock construction, dredging, aquaculture, oil and gas exploration and extraction, increased under water noise and boat traffic can degrade marine habitats used by sea turtles (Colburn et al. 1996). The development of marinas and docks in inshore waters can negatively impact nearshore habitats. An increase in the number of docks built increases boat and vessel traffic. Fueling facilities at marinas can sometimes discharge oil, gas, and sewage into sensitive estuarine and coastal habitats. Although these contaminant concentrations do not likely affect the more pelagic waters, the species of turtles analyzed in this opinion travel between near shore and offshore habitats and may be exposed to and accumulate these contaminants during their life cycles.

The Gulf of Mexico is an area of high-density offshore oil extraction with chronic, low-level spills and occasional massive spills (such as the recent DWH oil spill, Ixtoc I oil well blowout and fire in the Bay of Campeche in 1979, and the explosion and destruction of a loaded supertanker, the Mega Borg, near Galveston in 1990). Oil spills can impact wildlife directly through three primary pathways: ingestion – when animals swallow oil particles directly or consume prey items that have been exposed to oil, absorption – when animals come into direct contact with oil, and inhalation – when animals breath volatile organics released from oil or from "dispersants" applied by response teams in an effort to increase the rate of degradation of the oil in seawater. Several aspects of sea turtle biology and behavior place them at particular risk, including the lack of avoidance behavior, indiscriminate feeding in convergence zones, and large pre dive inhalations (Milton et al. 2003). When large quantities of oil enter a body of water, chronic effects such as cancer, and direct mortality of wildlife becomes more likely (Lutcavage et al. 1997). Oil spills in the vicinity of nesting beaches just prior to or during the nesting season could place nesting females, incubating egg clutches, and hatchlings at significant risk (Fritts et al. 1982; Lutcavage et al. 1997; Witherington 1999). Continuous low-level exposure to oil in the form of tar balls, slicks, or elevated background concentrations also challenge animals facing other natural and anthropogenic stresses. Types of trauma can include skin irritation, altering of the immune system, reproductive or developmental damage, and liver disease (Keller et al. 2004; Keller et al. 2006). Chronic exposure may not be lethal by itself, but it may impair a turtle's overall fitness so that it is less able to withstand other stressors (Milton et al. 2003).

The earlier life stages of living marine resources are usually at greater risk from an oil spill than adults. This is especially true for hatchlings, since they spend a greater portion of their time at the sea surface than adults; thus, their risk of exposure to floating oil slicks is increased (Lutcavage et al. 1995). One of the reasons might be the simple effects of scale: for example, a given amount of oil may overwhelm a smaller immature organism relative to the larger adult. The metabolic machinery an animal uses to detoxify or cleanse itself of a contaminant may not be fully developed in younger life stages. Also, in early life stages, animals may contain proportionally higher concentrations of lipids, to which many contaminants such as petroleum hydrocarbons bind. Most reports of oiled hatchlings originate from convergence zones, ocean areas where currents meet to form collection

, and/or salt-gland function—similar to the empirically demonstrated effects of oil alone (Shigenaka et al. 2003). Oil cleanup activities can also be harmful. Earth-moving equipment can dissuade females from nesting and destroy nests, containment booms can entrap hatchlings, and lighting from nighttime activities can misdirect turtles (Witherington 1999).

There are studies on organic contaminants and trace metal accumulation in green and leatherback sea turtles (Aguirre et al. 1994; Caurant et al. 1999; Corsolini et al. 2000). Mckenzie et al. (1999) measured concentrations of chlorobiphenyls and organochlorine pesticides in sea turtles tissues collected from the Mediterranean (Cyprus, Greece) and European Atlantic waters (Scotland) between 1994 and 1996. Omnivorous loggerhead turtles had the highest organochlorine contaminant concentrations in all the tissues sampled, including those from green and leatherback turtles (Storelli et al. 2008). It is thought that dietary preferences were likely to be the main differentiating factor among species. Decreasing lipid contaminant burdens with turtle size were observed in green turtles, most likely attributable to a change in diet with age. Sakai et al. (1995) found the presence of metal residues points for material at or near the surface of the water. Sixty-five of 103 post-hatchling loggerheads in convergence zones off Florida's east coast were found with tar in the mouth, esophagus or stomach (Loehefener et al. 1989). Thirty-four percent of post-hatchlings captured in sargassum off the Florida coast had tar in the mouth or esophagus and more than 50% had tar caked in their jaws (Witherington 1994). These zones aggregate oil slicks, such as a Langmuir cell, where surface currents collide before pushing down and around, and represents a virtually closed system where a smaller weaker sea turtle can easily become trapped (Carr 1987; Witherington 2002). Lutz (1989) reported that hatchlings have been found apparently starved to death, their beaks and esophagi blocked with tarballs. Hatchlings sticky with oil residue may have a more difficult time crawling and swimming, rendering them more vulnerable to predation.

Frazier (1980) suggested that olfactory impairment from chemical contamination could represent a substantial indirect effect in sea turtles, since a keen sense of smell apparently plays an important role in navigation and orientation. A related problem is the possibility that an oil spill impacting nesting beaches may affect the locational imprinting of hatchlings, and thus impair their ability to return to their natal beaches to breed and nest (Milton et al. 2003). Whether hatchlings, juveniles, or adults, tar balls in a turtle's gut are likely to have a variety of effects – starvation from gut blockage, decreased absorption efficiency, absorption of toxins, effects of general intestinal blockage (such as local necrosis or ulceration), interference with fat metabolism, and buoyancy problems caused by the buildup of fermentation gases (floating prevents turtles from feeding and increases their vulnerability to predators and boats), among others. Also, trapped oil can kill the seagrass beds that turtles feed upon.

Unfortunately, little is known about the effects of dispersants on sea turtles, and such impacts are difficult to predict in the absence of direct testing. While inhaling petroleum vapors can irritate turtles' lungs, dispersants can interfere with lung function through their surfactant (detergent) effect. Dispersant components absorbed through the lungs or gut may affect multiple organ systems, interfering with digestion, respiration, excretion occurring in loggerhead turtle organs and eggs. Storelli et al. (2008) analyzed tissues from twelve loggerhead sea turtles stranded along the Adriatic Sea (Italy) and found that characteristically, mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals and porpoises (Law et al. 1991). No information on detrimental threshold concentrations is available, and little is known about the consequences of exposure of organochlorine compounds to sea turtles. Research is needed on the short- and long-term health and fecundity effects of chlorobiphenyl, organochlorine, and heavy metal accumulation in sea turtles.

Nutrient loading from land-based sources, such as coastal communities and agricultural operations, are known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. An example is the large area of the Louisiana continental shelf with seasonally-depleted oxygen levels (< 2 mg/Liter) is 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 km^2, approximately twice the average size measured between 1985 and 1992. The hypoxic zone attained a maximum measured extent in 2002, when it was about 22,000 km^2 which is larger than the state of Massachusetts (USGS 2005). 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 southeastern shrimp trawl fisheries. 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. NMFS has agreements with all states in the action area. 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.

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 requiring 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; NMFS and USFWS 2007b; NMFS and USFWS 2007c; NMFS and USFWS 2007d; NMFS and USFWS 2007e). The Services published a final rule on September 22, 2011, listing loggerhead sea turtles as separate DPSs.

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. The recent DWH oil spill is expected to have had an adverse impact on the baseline for sea turtles, but the extent of that impact is not yet well understood.

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 found primarily off peninsular Florida. Sub-adult and adult smalltooth sawfish may be found in the action area. Juvenile smalltooth sawfish spend the majority of their time in shallow waters outside of the action area. Smalltooth sawfish found in the action area can be affected by the proposed action. Based on this information, the range-wide status of smalltooth sawfish described in Section 3.0 most accurately reflects the species' status within the action area.

As stated in Section 2.0, the proposed action will occur throughout the Atlantic Ocean and Gulf of Mexico in the EEZ. This analysis examines actions that may affect the environmental baseline for smalltooth sawfish within the action area.

4.3.1 Federal Actions

Federal fisheries in the action area adversely affect smalltooth sawfish via hooking and entanglement in associated gear. Formal section 7 consultations have been conducted on South shark fisheries in the South Atlantic and Gulf of Mexico and the Gulf of Mexico reef fish fishery. A summary of each consultation is provided below; more detailed information can be found in the respective most recent opinions (NMFS 2008; NMFS-SEFSC 2011).

Atlantic shark fisheries managed under the HMS FMP throughout the U.S. EEZ in the Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea include commercial shark bottom longline and drift gillnet fisheries, as well as recreational shark fisheries. The commercial shark bottom longline and drift gillnet fisheries are both known to adversely affect smalltooth sawfish. NMFS (2008) concluded the proposed action was not likely to jeopardize the continued existence of the smalltooth sawfish. An ITS was provided authorizing non-lethal takes.

The Gulf of Mexico reef fish fishery used to use three basic types of gear: spear or powerhead, trap and hook-and-line gear. Hook-and-line gear used in the fishery includes both commercial bottom longline and commercial and recreational vertical line (handline, bandit gear, rod and reel). Trap gear was phased-out completely by February 2007, but prior to that likely resulted in a few smalltooth sawfish entanglements. The hook-and-line components of the fishery has likely always had the most adverse effects on smalltooth sawfish. However, all consultations to date have concluded the fishery is not likely to jeopardize the continued existence of the smalltooth sawfish. An ITS was provided authorizing non-lethal takes in the commercial and recreational hook-and-line components of the fishery.

Smalltooth sawfish may infrequently be taken in other GOM federal fisheries using gillnets and hook-and-line. However, data substantiating such takings is lacking. NMFS is collecting data to analyze the impacts of these fisheries and will complete section 7 consultations as appropriate.

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. As of March 2012, NMFS has issued two research permits for directed research on the smalltooth sawfish. The permits allow researchers to capture, handle, collect tissue samples, and tag up smalltooth sawfish in Florida waters (both South Atlantic and GOM). All take authorized under these two permits is non-lethal. Additionally, NMFS has authorized incidental take (non-lethal) of smalltooth sawfish scientific research for sea turtles.

4.3.2 State or Private Actions

A significant proportion of the Florida coast has been degraded by inland hydrological projects, urbanization, agricultural activities, and other anthropogenic activities such as dredging, canal development, sea wall construction, and mangrove clearing. These activities have led to the loss and degradation of smalltooth sawfish habitat and may adversely affect their recovery.

State fisheries conducted in waters off the coast of Florida are known to occasionally take smalltooth sawfish. Fishers who capture smalltooth sawfish most commonly are recreationally fishing for snook (*Centropomus undecimalis*), redfish (*Scianops ocellatus*), and sharks (Simpfendorfer and Wiley 2004). Encounter data indicate that the majority of these takes are non-lethal. NMFS is encouraging the Florida Fish and Wildlife Commission (FWC) to apply for an ESA section 10 incidental take permit for its fisheries.

4.3.3 Other Potential Sources of Impacts in the Environmental Baseline

Smalltooth sawfish may be indirectly affected by anthropogenic marine pollution. The impacts from marine pollution are difficult to measure.

Marine Pollution
Sources of pollutants along the Atlantic and GOM coastal regions include atmospheric loading of pollutants such as polychlorinated biphenyl compounds (PCBs), stormwater runoff from coastal towns and cities into rivers and canals emptying into bays and the ocean, and groundwater and other discharges. Nutrient loading from land-based sources such as coastal community discharges is known to stimulate plankton blooms in closed or semi-closed estuarine systems. As noted in Section 3.0, the effects on larger embayments are unknown. Although pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo et al. 1986), the impacts of many other anthropogenic toxins have not been investigated for smalltooth sawfish. As described in Section 3.0, no specific information is available on the effects of pollution on smalltooth sawfish but evidence from other elasmobranchs suggests that pollution disrupts endocrine systems and potentially leads to reproductive failure (Gelsleichter et al. 2006). Smalltooth sawfish have been encountered with

polyvinyl pipes and fishing gear on their rostrum (Gregg Poulakis pers. comm. to Shelley Norton 2007).

4.3.4 Conservation and Recovery Actions Shaping the Environmental Baseline

Regulations restricting the use of fishing gears 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).

Research, monitoring, and outreach efforts on smalltooth sawfish are providing valuable information on which to base effective conservation management measures. Monitoring and research programs for the smalltooth sawfish are ongoing in southwest Florida. Surveys are conducted using longlines, setlines, gillnets, rod and reel, and seine nets. 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 FLMNH and NMFS websites.[4] These organizations and individuals also educate the public about sawfish status and conservation through regular presentations at various public meetings and during interviews with the media.

On January 21, 2009, NMFS published the final recovery plan for the U.S. DPS of smalltooth sawfish. NMFS is implementing recovery actions identified in the plan based on the recovery action's priority and available funding. Additionally, a 5-year review of the species status was published in October of 2010. The 5-year review concluded that the U.S. DPS of smalltooth sawfish remains vulnerable to extinction, and the species still meets the definition of endangered under the ESA, in that the species is in danger of extinction throughout its range. The recovery plan and the 5-year review are available at http://sero.nmfs.noaa.gov/pr/SmalltoothSawfish.htm.

The FWRI is responsible for collecting a wide variety of estuarine and marine fisheries data for the State of Florida (e.g., stock assessments, life history, fisheries-dependent monitoring, and fisheries-independent monitoring). Headquartered in St. Petersburg, the FWRI has seven field laboratories located in East Point, Cedar Key, Port Charlotte, Marathon, Tequesta, Melbourne, and Jacksonville, which conduct estuarine and marine research and monitoring activities in their regions. The fisheries sampling conducted statewide by the State of Florida has the potential to provide a significant amount of data on smalltooth sawfish, especially as recovery of the species progresses and sawfish move beyond their current south Florida range.

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[4] http://www.flmnh.ufl.edu/fish/Sharks/Sawfish/SRT/srt.htm and http://www.sero.nmfs.noaa.gov/pr/SmalltoothSawfish.htm

The FWC's Fisheries-Dependent Monitoring Program, in cooperation with NMFS, collects and compiles data on recreational landings, commercial landings, and processed fishery products in Florida. The recreational landings are collected as part of the Marine Recreational Fishing Statistical Survey (also now known as the Marine Recreational Information Program). Data collected from this program can be used to monitor the recovery of the smalltooth sawfish throughout Florida.

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 reported or documented from the action area. 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 and due to lack of reporting. As the population slowly grows, fisheries and other activity stressors in the action area may have a greater impact on the species.

4.4 Factors Affecting Atlantic Sturgeon within the Action Area

4.4.1 Federal Actions

NMFS authorizes a number of fisheries and other federal actions, and has undertaken a number of section 7 consultations to address the effects of those activities on other threatened and endangered species, such as sea turtles. Atlantic sturgeon were not included in those consultations since they were only recently listed; however, each of those consultations sought to minimize the adverse impacts on listed species and some of those conservation measures may benefit Atlantic sturgeon (e.g., the use of sea turtle excluder devices). The summary below of federal actions and the effects these actions have had on Atlantic sturgeon includes only those federal actions in the action area that we have already concluded consultation on or that are currently undergoing formal Section 7 consultation.

4.4.1.1 Fisheries

Atlantic sturgeon are known to be adversely affected by gillnets and otter trawls. Fisheries in the South Atlantic that NMFS authorizes the use of gillnet for under FMPs include coastal migratory pelagic resources fisheries, Atlantic HMS directed shark fisheries. Atlantic sturgeon bycatch mainly occurs in gillnets, with the greatest number of captures and highest mortality rates occurring in sink gillnets. The South Atlantic federal shrimp fishery is the fishery in the South Atlantic that NMFS authorizes the use of otter trawls. Based on available bycatch data, which suggests sturgeon are primarily caught in waters less than 50 meters deep, fishing using trawl and gillnet gear in waters greater than 50 meters deep may not have Atlantic sturgeon bycatch. Estimates for Atlantic sturgeon bycatch in these fisheries are largely unavailable as there is limited observer coverage in fisheries potentially capturing Atlantic sturgeon in the South Atlantic (North Carolina to Florida) federal waters. Although these fisheries have previously been consulted on for their effects on listed species, because of their recent listing, impacts to Atlantic sturgeon were not include in these past consultations. A brief summary of each of these fisheries is provided below, but more detailed information can be found in the respective opinions (NMFS 2002; NMFS 2007; NMFS 2008)

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 2007). 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 2007). No bycatch estimate for this fishery is available, but bycatch levels are likely to be very low since gillnets are not longer the predominant gear used on the Atlantic Coast.

Atlantic HMS Directed Shark Fisheries
In 2008, NMFS 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). Atlantic HMS commercial directed shark fisheries use bottom longline and gillnet gear. Gillnets are the dominant gear for catching small coastal sharks; most shark gillnetting occurs off southeast Florida. No bycatch estimate for this fishery is available, but it is likely to be very low since gillnets are primarily only used at the southern edge of the marine range of Atlantic sturgeon, where presence of the species is thought to be rare.

The South Atlantic Federal Shrimp Fishery
No Atlantic sturgeon bycatch in this federal fishery have been observed, but bycatch documented in adjacent state waters (see data presented later under Private and State Actions) indicate that interactions may just have gone undetected. This fishery is being analyzed in this document as part of the proposed action so only its part effects are considered as part of this environmental baseline.

4.4.1.2 Military Activities

Military ordnance detonation also affects listed species, though the degree to which Atlantic sturgeon are affected is unknown. Section 7 consultations were conducted for U.S. Navy (USN), U.S. Air Force (USAF), and U.S. Marine Corps (USMC) activities. These consultations did not include Atlantic sturgeon because the species was not yet listed, though it was determined each activity was likely to adversely affect sea turtles. Section 7 consultation was completed for 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), and the operation of the U.S. Coast Guard’s boats and cutters in the U.S. Atlantic (NMFS 1995). NMFS has also consulted on military training operations conducted by the USAF and USMC. From 1995-2007, three consultations were completed that evaluated the impacts of ordnance detonation during gunnery training or aerial bombing exercises (NMFS 1997; NMFS 2004; NMFS 2005).

4.4.1.3 Dredging

The construction and maintenance of Federal navigation channels has also been identified as a source of mortality to listed species, such as Atlantic sturgeon. Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore borrow areas, move relatively rapidly and can entrain and kill Atlantic sturgeon, presumably as the drag arm of the moving dredge overtakes the slower moving fish. Between 1990 and 2005, 10 Atlantic sturgeon were reported captured by hopper dredges (ASSRT and NMFS 2007). On May 27, 1997, NMFS completed an opinion on the continued hopper dredging of channels and borrow areas in the southeast United States. Atlantic sturgeon were not listed at the time and were not included in the consultation, though it was determined hopper dredging would adversely affect sea turtles. NMFS is currently reinitiating consultation on dredging and beach renourishment activities of the U.S. Army Corps of Engineers, South Atlantic Region.

4.4.2 State or Private Actions

4.4.2.1 State Fisheries

Atlantic sturgeon are also known to be adversely affected by gillnets and otter trawls. In fact, given these gear types are used most frequently in state waters, state fisheries may have a greater impact on Atlantic sturgeon than federal fisheries using these same gear types.

The NCDMF reported that no Atlantic sturgeon were observed in 958 observed tows conducted by commercial shrimp trawlers working in North Carolina waters during 2001-2009 (L. Daniel, NCDMF, pers. comm.). Collins et al. (1996) did a study of commercial bycatch of shortnose and Atlantic sturgeon. They tagged 1,534 juvenile Atlantic sturgeon in the Altamaha River, Georgia. Of the 97 Atlantic sturgeon recaptured in trawl and gillnet fisheries, 38 Atlantic sturgeon (or 39 percent of the total recaptures) were taken in shrimp trawls. Seven Atlantic sturgeon were captured by a single shrimp trawler off Winyah Bay, South Carolina, from October 27-29, 2008 (E. Scott-Denton, NOAA, pers. comm.). Six of these were caught in otter trawl nets and one was captured in a try net. All of them were approximately 900 to 1000 mm total length and were caught in 18-30 feet of water. Six of the incidentally caught Atlantic sturgeon were released alive, one (captured by the otter trawl) was released dead. There were also a few observed capture in 2011. One Atlantic sturgeon was captured by a shrimp trawler off South Carolina near Kiawah Island, South Carolina, on December 13, 2011 (E. Scott-Denton, NOAA, pers. comm.) and was released alive. Two Atlantic sturgeon were captured by a shrimp trawler near Sapelo Island, Georgia, from December 27-29, 2011 (E. Scott-Denton, NOAA, pers. comm.). Both were approximately 2 feet long and both were released alive.

4.4.2.2 Scientific Research

Atlantic sturgeon research has been coordinated by the Atlantic States Marine Fisheries Commission (ASMFC) (prior to an ESA listing). The ASMFC has issued a number of permits for ongoing research projects on the species, which have lethal and non-lethal effects on the species. Though most research is focused in riverine and nearshore areas, a winter tagging cruise has been conducted offshore of Virginia and North Carolina since 1988 to better understand

Atlantic sturgeon geographic distribution and habitat use, as well as risk of bycatch. Between 1988 and 2006, 146 Atlantic sturgeon were captured. No immediate mortalities have ever been reported during the tagging cruise.

4.4.3 Other Potential Sources of Impacts in the Environmental Baseline

4.4.3.1 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 or even to attribute to federal, state, local, or private actions. Where possible, conservation actions are being implemented to monitor or study impacts from these sources.

4.4.3.2 Marine Pollution and Environmental Contamination

Anthropogenic sources of marine pollution, while difficult to attribute to a specific federal, state, local or private action, may indirectly affect Atlantic sturgeon in the action area. Sources of pollutants in the action area include atmospheric loading of pollutants such as PCBs; storm water runoff from coastal towns, cities, and villages; and runoff into rivers that empty into bays and groundwater.

Atlantic sturgeon may be particularly susceptible to impacts from environmental contamination due to their benthic foraging behavior and long-life span. Sturgeon using estuarine habitats near urbanized areas may be exposed to numerous suites of contaminants within the substrate. Contaminants, including toxic metals, polychlorinated aromatic hydrocarbons (PAHs), organophosphate and organochlorine pesticides, polychlorinated biphenyls (PCBs), and other chlorinated hydrocarbon compounds can have substantial deleterious effects on aquatic life. Effects from these elements and compounds on fish include production of acute lesions, growth retardation and reproductive impairment (Cooper 1989; Sindermann 1994).

Heavy metals and organochlorine compounds accumulate in sturgeon tissue, but their long-term effects are not known (Ruelle and Henry 1992; Ruelle and Keenlyne 1993). Elevated levels of contaminants, including chlorinated hydrocarbons, in several other fish species are associated with reproductive impairment (Cameron et al. 1992; Longwell et al. 1992; Hammerschmidt et al. 2002; Drevnick and Sandheinrich 2003), reduced egg viability (Von Westernhagen et al. 1981; Giesy et al. 1986; Mac and Edsall 1991; Matta et al. 1997; Billsson et al. 1998), reduced survival of larval fish (Berlin et al. 1981; Giesy et al. 1986), delayed maturity (Jorgensen et al. 2004) and posterior malformations (Billsson et al. 1998). Pesticide exposure in fish may affect antipredator and homing behavior, reproductive function, physiological development, and swimming speed and distance (Beauvais et al. 2000; Scholz et al. 2000; Moore and Waring 2001; Waring and Moore 2004). Moser and Ross (1995) suggested that certain deformities and ulcerations found in Atlantic sturgeon in North Carolina’s Brunswick River might be due to poor water quality in addition to possible boat propeller inflicted injuries. It should be noted that the effect of multiple contaminants or mixtures of compounds at sub-lethal levels on fish has not been adequately studied. Atlantic sturgeon use marine, estuarine, and freshwater habitats and are in direct contact through water, diet, or dermal exposure with multiple contaminants throughout their range.

Sensitivity to environmental contaminants varies among fish species and life stages. Early life stages of fish seem to be more susceptible to environmental and pollutant stress than older life stages (Rosenthal and Alderdice 1976). In aquatic toxicity tests (Dwyer et al. 2000), Atlantic sturgeon fry were more sensitive to five contaminants (carbaryl, copper sulfate, 4-nonylphenol, pentachlorophenol, and permethrin) than fathead minnow (*Pimephales promelas*), sheepshead minnow (*Cyprinodon variegatus*), and rainbow trout (*Oncorhynchus mykiss)* - three common toxicity test species - and 12 other species of threatened and endangered fishes. The authors note, however, that Atlantic sturgeon were difficult to test and conclusions regarding chemical sensitivity should be interpreted with caution.

Another suite of contaminants occurring in fish are metals (mercury, cadmium, selenium, lead, etc.), also referred to as trace metals, trace elements, or inorganic contaminants. Post (1987) states that toxic metals may cause death or sub-lethal effects to fish in a variety of ways and that chronic toxicity of some metals may lead to the loss of reproductive capabilities, body malformation, inability to avoid predation, and susceptibility to infectious organisms.

Dioxin and furans were detected in ovarian tissue from shortnose sturgeon caught in the Sampit River/Winyah Bay system (SC). Results showed that four out of seven fish tissues analyzed contained tetrachlorodibenzo-*p*-dioxin (TCDD) concentrations greater than 50 pg/g (parts-per-trillion), a level which can adversely affect the development of sturgeon fry (J. LLIff, NOAA, Damage Assessment Center, Silver Spring, MD, unpublished data).

The EPA published its second edition of the National Coastal Condition Report (NCCR II) in 2004, which is a “report card” summarizing the status of coastal environments along the coast of the United States (EPA 2004). The report analyzes water quality, sediment, coastal habitat, benthos, and fish contaminant indices to determine status. In contrast to the Northeast (Virginia - Maine), which received an overall grade of F, the Southeast region (North Carolina - Florida) received an overall grade of B-, which is the best rating in the nation with no indices below a grade of C (Table 9). Areas of concern that had poor index scores within the action area include were Pamlico Sound and the ACE Basin for water quality, and St. Johns River for sediment. There was also a mixture of poor benthic scores scattered along Southeast region.

4.4.4 Conservation and Recovery Actions Benefitting Atlantic Sturgeon

4.4.4.1 State and Federal Moratoria on Atlantic Sturgeon

The Atlantic sturgeon is managed under an FMP implemented by the ASMFC. In 1998, the ASFMC instituted a coast-wide moratorium on the harvest of Atlantic sturgeon, which is to remain in effect until there are at least 20 protected age classes in each spawning stock (anticipated to take up to 40 or more years). NMFS followed the ASMFC moratorium with a similar moratorium for Federal waters. Amendment 1 to ASMFC's Atlantic sturgeon FMP also includes measures for preservation of existing habitat, habitat restoration and improvement, monitoring of bycatch and stock recovery, and breeding/stocking protocols.

4.4.4.2 Use of Turtle Excluder Devices in Trawl Fisheries

Atlantic sturgeon benefit from the use of devices designed to exclude other species, such as sea turtles. Turtle excluder device (TED) and bycatch reduction device requirements may reduce Atlantic sturgeon bycatch in Southeast trawl fisheries (ASSRT and NMFS 2007). NMFS has required the use of TEDs in at least some southeast United States shrimp trawls since 1989. These regulations have been refined over the years to ensure that TED effectiveness is maximized through more widespread use, and proper placement, installation, configuration (e.g., width of bar spacing), and floatation. NMFS has also been working to develop a TED, which can be effectively used in a type of trawl known as a flynet. Fly nets are used in the winter, mixed species trawl fishery, off North Carolina, primarily targeting croaker and weakfish. A top-opening flynet TED was certified in the summer of 2007, but experiments are still ongoing to certify a bottom-opening TED. Atlantic sturgeon were observed to escape through the TED during flynet TED testing in 2008 and 2009.

4.5 Factors Affecting Gulf Sturgeon in the Action Area

As stated in Section 2.4 (Action Area), the action area includes the Gulf and South Atlantic EEZ and adjacent marine and tidal state waters of the Gulf and South Atlantic area (i.e., from the Texas-Mexico border to the North Carolina-Virginia border). Because Gulf sturgeon do not occur in the Atlantic Ocean, the following analysis examines only actions occurring in the Gulf of Mexico that may affect the environmental baseline. The environmental baseline for Gulf sturgeon includes the effects of several activities that may affect the survival and recovery of the threatened Gulf sturgeon in the action area.

4.5.1 Federal Actions

4.5.1.1 Fisheries

Federal fisheries in the Gulf of Mexico use a variety of gear types including trawls, gillet, pelagic and bottom longline, and other types of hook-and-line. Of these gear types, Gulf sturgeon are believed to be susceptible to capture only in trawl and gillnet gear via entanglement.
Federal fisheries that NMFS authorizes in the Gulf of Mexico have likely had a minor impact on Gulf sturgeon. This is because Gulf sturgeon occur in the Gulf of Mexico only during winter months and during that time, most migrate alongshore and to barrier island habitats within shallower state waters. The December 15, 2009, observed shrimp trawl capture that triggered this consultation for Gulf sturgeon is the first and only observed bycatch record in federal waters and was released alive. Prior to this consultation, section 7 consultations on federal fisheries, have always discounted effects on Gulf sturgeon because of their rarity on federal waters. The new record indicates that past captures in at least trawl gear likely have occurred, but they are still believed to have been rare.

4.5.1.2 Vessel Operations and Additional Military Activities

NMFS has recently completed four consultations on Eglin Air Force Base testing and training activities in the GOM. These activities have not been found to adversely Gulf sturgeon.

4.5.1.3 Oil and Gas Exploration and Extraction

NMFS has analyzed Federal and state oil and gas exploration, production and development, explosive removal of offshore structures, and seismic exploration for potential effects to Gulf sturgeon. Opinions issued by NMFS on August 28, 2006 (NMFS 2006), July 11, 2002 (NMFS 2002), November 29, 2002 (NMFS 2002), August 30, 2003 [Lease Sales 189 and 197, (NMFS 2003)], and June 29, 2007 [2007-2012 Five-Year Lease Plan, (NMFS 2007)] all concluded that these activities have had no effect on Gulf sturgeon.

4.5.1.4 Deepwater Horizon Oil Spill

On April 20, 2010, there was a massive oil spill in the Gulf of Mexico at British Petroleum's Deepwater Horizon well. Official estimates are that 4.9 million barrels of oil were released into the Gulf, with some experts estimating even higher volumes. The full environmental impact of this disaster will not be known for years to come and may never be known. Assessing the current impacts of this oil spill on Gulf sturgeon and their designated critical habitat is difficult because so much remains unknown or unclear about the impacts to the environment and habitat. Given these uncertainties, it is not practical to speculate on spill effects to the Gulf sturgeon environmental baseline at this time. However, we expect the primary route of effects to designated critical habitat from the release of oil and subsequent clean-up efforts is to the benthos and the benthic community it supports. There are at least two routes of exposure: suffocation of infaunal organisms and toxicity of substrate. Both of these effects would impact the abundance of Gulf sturgeon prey. The long term impact to Gulf sturgeon and their designated critical habitat from exposure to oil and the subsequent response and clean-up efforts is currently unknown.

4.5.1.5 Federally-Permitted Discharges

Federally-regulated stormwater and industrial discharges and chemically-treated discharges from sewage treatment systems may impact Gulf sturgeon and their critical habitat. NMFS continues to consult with EPA to minimize the effects of these activities on both listed species and designated critical habitat. In addition, other federally-permitted construction activities, such as beach restoration, have the potential to impact Gulf sturgeon critical habitat.

4.5.1.6 Federal Maintenance Dredging

Riverine, estuarine, and coastal navigation channels are often dredged to support commercial shipping and recreational boating. Dredging activities can pose significant impacts to aquatic ecosystems by: (1) direct removal/burial of organisms; (2) turbidity/siltation effects;(3) contaminant re-suspension; (4) noise/disturbance; (5) alterations to hydrodynamic regime and physical habitat; and (6) loss of riparian habitat (Chytalo 1996; Winger et al. 2000). Dredging operations may also destroy benthic feeding areas, disrupt spawning migrations, and re-suspend fine sediments causing siltation over required substrate in spawning habitat. Because Gulf sturgeon are benthic omnivores, the modification of the benthos affects the quality, quantity, and availability of prey.

Hydraulic dredges (e.g., hopper) can lethally harm sturgeon directly by entraining sturgeon in dredge drag arms and impeller pumps. Mechanical dredges have also been documented to kill shortnose, Atlantic, and Gulf sturgeon (Dickerson 2005). Dickerson (2005) summarized observed takings of 24 sturgeon from dredging activities conducted by the Corps and observed between 1990 and 2005 (2 Gulf; 11 shortnose; and 11 Atlantic). Of the three types of dredges included (hopper, clam and pipeline) in the report, hopper dredges captured the most sturgeon. Notably, reports include only those limited trips when an observer was on board to document capture and does not include sturgeon purposefully removed from the project area prior to dredging activities.

To reduce take of listed species, relocation trawling may be utilized to capture and move sea turtles and sturgeon. In relocation trawling, a boat equipped with nets precedes the dredge to capture sturgeon and sea turtles and then releases the animals out of the dredge pathway, thus avoiding lethal take. Relocation trawling has been successful and routinely moves sturgeon in the Gulf of Mexico. In relocation trawling, a boat equipped with nets precedes the dredge to capture sturgeon and sea turtles and then releases the animals out of the dredge pathway, thus avoiding lethal take. Between January 2005 and April 2006 relocation trawling captured and successfully moved two Gulf sturgeon near Mobile Bay, AL: 5 near Gulf Shores, AL, 1 near Destin, FL, and 8 near Panama City Beach, FL. Seasonal in-water work periods, when the species is absent from the project area, also assists in reducing incidental take.

In 2003, NMFS completed a regional opinion on hopper dredging in the Gulf of Mexico that includes impacts to Gulf sturgeon and its critical habitat via maintenance dredging. NMFS concluded eight Gulf sturgeon may be killed or injured annually in COE Gulf of Mexico hopper dredging operations and up to one killed or injured annually during annual relocation trawling in the Gulf of Mexico.

In summary, dredging and disposal to maintain navigation channels, and removal of sediments for beach renourishment occurs frequently and throughout the range of the Gulf sturgeon and within designated Gulf sturgeon habitat annually. This activity has, and continues to threaten the species and affect its designated critical habitat.

4.5.1.7 ESA Permits

There are no federal permits for Gulf sturgeon research. The states have permitting authority (56 FR 49658; September 30, 1991) and no annual reporting is required.

4.5.2 State or Private Actions

The Gulf sturgeon recovery plan (NMFS and USFWS 1995) documents that Gulf sturgeon are occasionally incidentally captured in state shrimp fisheries in bays and sounds along the northern Gulf of Mexico. There is one recorded interaction (E. Scott-Denton, NOAA, pers. com.) of a Gulf sturgeon with the shrimp trawl fishery: one in state waters (December 15, 2009).

In the Pearl River a trammel/gillnet fishery is conducted for gar. Because of the gear (minimum of three inch mesh square, up to 3,000 ft in length) and the year-around nature of the fishery, it is probable that Gulf sturgeon are intercepted in this fishery. While state regulations prohibit taking or possession of whole or any body parts, including roe, there is no reporting to determine capture or release rates.

A number of activities that may indirectly affect Gulf sturgeon including discharges from wastewater systems, dredging, ocean pumping and disposal, and aquaculture facilities. The impacts from these activities are difficult to measure. However, where possible, conservation actions through the ESA section 7 process, ESA section 10 permitting, and state permitting programs are being implemented to monitor or study impacts from these sources.

Increasing coastal development and ongoing beach erosion will result in increased demands by coastal communities, especially beach resort towns, for periodic privately-funded or federally-sponsored beach renourishment projects. These activities may affect Gulf sturgeon and their critical habitat by burying nearshore habitats that serve as foraging areas.

4.5.3 Other Potential Sources of Impacts in the Environmental Baseline

4.5.3.1 Marine Pollution and Environmental Contamination

Pollution from industrial, agricultural, and municipal activities is believed responsible for a suite of physical, behavioral, and physiological impacts to sturgeon worldwide (Karpinsky 1992; Barannikova 1995; Barannikova et al. 1995; Khodorevskaya et al. 1997; Bickham et al. 1998; Khodorevskaya and Krasikov 1999; Billard and Lecointre 2001; Kajiwara et al. 2003; Agusa et al. 2004). Although little is known about contaminant effects on Gulf Sturgeon, a review estimating potential reactions has been performed (Berg 2006). It was found that loss of habitat associated with pollution and contamination has been documented for sturgeon species (Verina and Peseridi 1979; Shagaeva et al. 1993; Barannikova et al. 1995). Specific impacts of pollution and contamination on sturgeon have been identified to include muscle atrophy, abnormality of gonad, sperm and egg development, morphogenesis of organs, tumors, and disruption of hormone production (Graham 1981; Altuf'yev et al. 1992; Dovel et al. 1992; Georgi 1993; Romanov and Sheveleva 1993; Heath 1995; Khodorevskaya et al. 1997; Kruse and Scarnecchia 2002)).

More recently, pharmaceuticals and other endocrinologically active chemicals have been found in fresh and marine waters at effective concentrations [reviewed in (Fent et al. 2006)]. These compounds enter the aquatic environment via wastewater treatment plants, agricultural facilities, and farm runoff (Folmar et al. 1996; Culp et al. 2000; Wildhaber et al. 2000; Wallin et al. 2002). These products are the source of both natural and synthetic substances including, but not limited to, polychlorinated biphenyls, phthalates, pesticides, heavy metals, alkylphenols, polycyclic aromatic hydrocarbons, 17β-estradiol, 17α-ethinylestradiol, and bisphenol A (Pait and Nelson 2002; Aguayo et al. 2004; Nakada et al. 2004; Björkblom et al. 2009; Iwanowicz et al. 2009). The impact of these exposures on Gulf sturgeon is unknown, but other species of fish are affected in rivers and streams. For example, one major class of endocrine disrupting chemicals, estrogenic compounds, have been shown to affect the male to female sex ratio in fish in streams and rivers via decreased gonad development, physical feminization, and sex reversal (Folmar et al. 1996). Settlement of these contaminants to the benthos may affect benthic foragers to a greater extent than pelagic foragers due to foraging strategies (Geldreich and Clarke 1966).

Several characteristics of the Gulf sturgeon (i.e., long lifespan, extended residence in riverine and estuarine habitats, benthic predator) predispose the species to long-term and repeated exposure to environmental contamination and potential bioaccumulation of heavy metals and other toxicants. Chemicals and metals such as chlordane, DDE, DDT, dieldrin, PCBs, cadmium, mercury, and selenium settle to the river bottom and are later incorporated into the food web as they are consumed by benthic feeders, such as sturgeon or macroinvertebrates. Some of these compounds may affect physiological processes and impede the ability of a fish to withstand stress, while simultaneously increasing the stress of the surrounding environment by reducing DO, altering pH, and altering other water quality properties.

While laboratory results are not available for Gulf sturgeon, signs of stress observed in shortnose sturgeon exposed to low DO included reduced swimming and feeding activity coupled with increased ventilation frequency (Campbell and Goodman 2004), . Niklitschek (2001) observed that egestion levels for Atlantic and shortnose sturgeon juveniles increased significantly under hypoxia, indicating that consumed food was incompletely digested. Behavioral studies indicate that Atlantic and shortnose sturgeon are quite sensitive to ambient conditions of oxygen and temperature: in choice experiments juvenile sturgeons consistently selected nomoxic over hypoxic conditions (Niklitschek 2001). Beyond escape or avoidance, sturgeons respond to hypoxia through increased ventilation, increased surfacing (to ventilate relatively oxygen-rich surficial water), and decreased swimming and routine metabolism (Nonnotte et al. 1993; Crocker and Cech 1997; Secor and Gunderson 1998; Niklitschek 2001).

The majority of published data regarding contaminants and sturgeon health are limited to reports of tissue concentration levels. While these data are useful and allow for comparison between individuals, species, and regions, they do not allow researchers to understand the impacts of the concentrations. There is expectation that Gulf sturgeon are being negatively impacted by organic and inorganic pollutants given high concentration levels (Berg 2006). Gulf sturgeon collected from a number of rivers between 1985 and 1991 were analyzed for pesticides and heavy metals (Bateman and Brim 1994); concentrations of arsenic, mercury, DDT metabolites, toxaphene, polycyclic aromatic hydrocarbons, and aliphatic hydrocarbons were sufficiently high to warrant concern. More recently, 20 juvenile Gulf sturgeon from the Suwannee River, FL, exhibited an increase in metals concentrations with an increase in individual length (Alam et al. 2000).

Federal and state water quality standards are protective of most taxa in many habitats. However, impacts of reduced water quality continue to be realized at species-specific, and habitat-specific scales and magnification through the trophic levels continues to be assessed. The effects of most of these chemicals on the Gulf sturgeon or other protected species are poorly understood .Also, because there are thousands of chemicals interacting in our natural environment, many of them of human design, many do not have Federal or state water quality standards associated with them.

4.5.4 Conservation and Recovery Actions Benefiting Gulf sturgeon

4.5.4.1 Cooperation with the States

Anthropogenic marine debris, pollution, runoff, and nutrient loading, stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. Coupled with atmospheric loading of pollutants such as PCBs, these impacts are difficult to measure. Where possible, conservation actions are being implemented to monitor or study impacts from these sources. For example the State of Florida recently required the COE to conduct pre- and post-construction prey surveys as part of a permit to remove sand for a beach renourishment project. NMFS is working with Florida to ensure that data and results will be useful in determining project impacts.

Cooperative conservation partnerships between NMFS and States can be formalized by entering into agreements pursuant to section 6 of the ESA. NMFS has established partnerships for cooperative research on Gulf sturgeon via conservation agreements in the Gulf of Mexico with the states of Florida, Alabama, Mississippi, and Louisiana. Prior to issuance of these agreements, the proposal must be reviewed for compliance with section 7 of the ESA.

Implementation of the Florida Net Ban (Amendment Three of the Florida Constitution) in 1995 has likely benefited sturgeon. The Net Ban made unlawful the use of entangling nets (i.e., gill and trammel nets) in Florida waters and likely benefitted or accelerated Gulf sturgeon recovery given residence of sturgeon in near-shore waters where tangling gear is commonly used during much of their life span. Capture of small Gulf sturgeon in mullet gill nets was documented by state fisheries biologists in the Suwannee River fishery in the early 1970s. Large mesh gill nets and runaround gill nets were the fisheries gear of choice in historic Gulf sturgeon commercial fisheries. Absence of this gear in Florida eliminates it as a potential source of mortality of Gulf sturgeon.

4.5.4.2 Use of Turtle Excluder Devices in Trawl Fisheries

Gulf sturgeon benefit from the use of devices inserted into trawl nets designed to exclude other species, such as sea turtles Evidence of exclusion from a shrimp trawl net was documented when an Atlantic sturgeon caught off South Carolina by a shrimp trawler in December 2011 exited the through the TED alive. Turtle excluder device (TED) and bycatch reduction device requirements are expected to reduce bycatch of the conspecific Atlantic sturgeon in Southeast trawl fisheries (ASSRT and NMFS 2007). NMFS has required the use of TEDs in some Gulf of Mexico shrimp trawls since 1989 and the regulations have been refined over the years to ensure effectiveness is maximized through more widespread use, and proper placement, installation, configuration (e.g., width of bar spacing), and floatation.

4.5.4.3 Gulf sturgeon Sampling Protocol

NMFS and USFWS established a standardized sampling protocol with the Gulf sturgeon researchers in 2010. Procedures for tagging were established, PIT tag frequencies were standardized, and a common datasheet was established. Tag information and morphometric data are being stored in a shared database managed by NMFS. A similar workshop to discuss and establish monitoring protocols is planned for April 2012.

4.5.4.4 Other Actions

In 2009, NMFS and USFWS completed a 5-year status review for Gulf sturgeon (USFWS and NMFS 2009) and concluded that the species continues to meet the status of a threatened species. As part of that review, NMFS and USFWS also critiqued the recovery criteria listed in the 1995 Recovery Plan (NMFS and USFWS 1995) and concluded that new criteria are necessary to: (1) reflect the best available and most up-to date information on the biology of the species, (2) address the five statutory listing/recovery factors, and (3) improve monitoring methods for demonstrating progress towards reducing threats and for determining when the protections of the Act are no longer necessary. NMFS and USFWS are actively working to revise and update the 1995 Gulf sturgeon recovery plan.

4.5.5 Summary and Synthesis of Environmental Baseline for Gulf sturgeon

In summary, few factors adversely affect Gulf sturgeon in the Gulf of Mexico. However, these factors are ongoing and are expected to occur contemporaneously with the proposed action. Gulf sturgeon will be taken annually through activities to maintain federal channels and sand mining for beach renourishment. Point and non-point runoff will continue to have adverse effects on estuarine and marine habitats. The recent DWH oil release event is expected to have had an adverse impact on the baseline for Gulf sturgeon critical habitat, but the extent of that impact is not yet well understood. Actions to conserve and recover Gulf sturgeon have significantly increased over the past 10 years and are expected to continue.

5.0 Effects of the Action

In this section, we assess the direct and indirect effects of (1) the continued implementation of the sea turtle conservation regulations, as proposed to be amended, and (2) the continued authorization of the Southeast U.S. shrimp fisheries in federal waters under the Magnuson-Stevens Act 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 species biology and the effects of the proposed action. Data are limited, so we are often forced to make assumptions to overcome the limits in our knowledge. Sometimes, 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).

Scope and Overall Approach to Assessment
After reviewing the proposed action, we believe the proper scope of the effect analysis for this opinion is: (1) the effect that NMFS' exemption of the take of sea turtles through its sea turtle conservation regulations has on listed species, (2) the effect that the sea turtle conservation regulations themselves have on listed species, and (3) the effect that federally-authorized shrimp fisheries (also subject to the sea turtle conservation regulations) have on listed species. Since the purpose of the sea turtle conservation regulations is to conserve all sea turtles (in both state and federal waters) and the TED regulations provide an exemption to state water shrimp trawl fishermen to incidentally capture sea turtles, we evaluate the regulations' sufficiency through this opinion and the jeopardy standard. We also look at how the sea turtle conservations regulations may affect other species via its TED requirements and tow time restrictions. NMFS has not promulgated any section 4(d) rules applicable to the shrimp fisheries that exempt the take of any other species beside sea turtles. Therefore, NMFS does not bear responsibility for the take of these other listed species in state-managed fisheries and does not authorize that take via the ITS. Lastly, we evaluate the effects of our authorizing of federal shrimp fisheries via our two FMPs, where we are solely responsible for all of the effects on listed species.

We begin our analysis of the effects of the action by first evaluating what activities associated with the proposed action are likely to adversely affect listed species in the action area (i.e., what the proposed action stressors are). For each species likely to be adversely affected by an identified stressor, we first review the range of responses to an individual's exposure, and then the factors affecting the likelihood, frequency, and severity of exposure. After that, our focus shifts to evaluating and quantifying exposure. We estimate the number of individuals of each species likely to be exposed and the likely fate of those animals.

Activities Likely to Adversely Affect Listed Species
In Section 3, we determined listed species likely to be adversely affected via gear interactions include sea turtles, smalltooth sawfish, and Gulf and Atlantic sturgeon. Potential routes of direct effects of the proposed action on these species include fishing gear interactions and vessel

interactions. Based on our understanding of the effects of the proposed action on these species, direct effects of the proposed action are expected to result only when listed species interact with active fishing gear. Smalltooth sawfish and sturgeon spend most of their time at or near the seafloor, where they are not subject to vessel interactions. Also, although sea turtles are susceptible to vessel collisions, shrimp trawl vessel collisions with sea turtles are extremely unlikely given the slow speed (2-3 knots) at which shrimp trawls travel.

There are no indirect effects associated with the proposed action that are likely to adversely affect listed species. An increased likelihood of sea turtles being struck by other vessels could be an indirect effect (i.e., effects caused by the proposed action that are later in time, but reasonably certain to occur) of shrimp trawling, given the presumption that a sea turtle recovering from a forced submergence encounter would most likely remain resting on the surface longer than it usually would. However, at this time there is no meaningful way to quantify what proportion of vessel-struck sea turtles were the result of such effects. Other potential routes of indirect effects of the proposed action include modification of substrate, disturbance of benthic habitat communities, and reduction of prey/foraging base via removal of non-target species. Although trawls physically disturb habitat as they are dragged along the bottom, the manner in which trawl gear temporarily degrades habitat by disturbing seabed animals and sediments is not likely to affect sea turtles, smalltooth sawfish, or sturgeon. We do not expect the disturbances to seabed animals or the harvesting of shrimp in the action area to result in a reduction in sea turtle, smalltooth sawfish, or sturgeon prey/foraging base. Benthic molluscan and crustacean prey items of Kemp's ridleys, loggerheads, and sturgeon could conceivably be affected by trawl disturbance, but such disturbance would be most likely to enhance foraging opportunities by making prey items more accessible. Similarly, fish and crustacean bycatch discarded by shrimp trawlers may also provide an easy scavenge. Thus, although some potential routes of indirect effects exist, there is little to suggest that shrimp trawling indirectly affects listed species significantly (i.e., to a level where adverse effects are expected to result). Lastly, there are no data indicating that nearshore shrimping activities disturb sea turtle mating or nesting or smalltooth sawfish behavior, and sturgeon do not mate or reproduce in the action area. Thus, potential indirect effects from the proposed action are not likely to adversely affect sea turtles, smalltooth sawfish, or sturgeon, and the remainder of this section will focus solely on direct effects associated with gear interactions.

5.1 Effects to Sea Turtles

Approach to the Assessment

In the following sections, we first review the range of responses an individual sea turtle may have when exposed to trawl gear (5.1.1), and then the factors affecting the likelihood, frequency, and severity of sea turtle exposure (5.1.2). After that, our focus shifts to evaluating and quantifying the extent the effects of otter trawls (5.1.3), skimmer trawls (5.1.4) and TED-exempted gears and activities (5.1.5) based on the best available information. Effects are generally broken down into three categories: interactions, captures, and mortalities. An interaction occurs anytime a sea turtle enters a shrimp trawl, regardless of whether it escapes through a properly-installed TED or fails to escape and is captured. For otter trawls and skimmer trawls, in quantifying captures, we adjust our capture estimates based on anticipated compliance with existing and proposed sea turtle conservation requirements based on documented TED compliance rates. After separately analyzing each component of the proposed action as specified above, in Section 5.1.6 we then summarize the overall results and discuss sources of error associated with our bycatch analyses.

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

Shrimp trawling directly affects sea turtles. As turtles rest, forage, or swim on or near the bottom, shrimp trawls, pulled across the bottom at 1.5 to 3 knots, can sweep over them. Shrimp trawls have an overhanging headrope to prevent shrimp from jumping over the mouth of the net when they are hit by the tickler chain or footrope. This overhang also probably prevents sea turtles from escaping shrimp trawls by heading for the surface. Video of wild loggerhead sea turtles encountering TEDs in trawls reveals that the sea turtles are usually oriented forward, apparently trying to outswim the advancing trawl footrope (NMFS Pascagoula Laboratory 2002). Because of the trawl's greater speed or the sea turtles' eventually tiring, the sea turtles gradually fall back toward the rear of the net where they encounter a TED or, if a TED is not installed, where they fall into the codend of the net and are caught. The vast majority of sea turtles encountering trawls equipped with properly-functioning TEDs are able to escape quickly and can surface to breathe. Sea turtles encountering an improperly installed TED may take longer to escape or be captured near or on the TED, depending on the extent of the violation. Captured sea turtles upon retrieval of the gear may be found dead, comatose, or alive, depending on the extent of forced submergence effects. The following discussion summarizes in greater detail available information on how individual sea turtles are likely to respond to trawl interactions.

General Effects of Forced Submergence
Sea turtles are air-breathing reptiles, thus need to be able to reach the water's surface to breathe. Although they are able to conduct lengthy voluntary dives, 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 (i.e., pH level of the blood). In contrast, sea turtles that are stressed as a result of being forcibly submerged in trawls maintain a high level of oxygen consumption, which can rapidly consume their oxygen stores and can result in large, potentially harmful internal changes. Those changes include a substantial increase in blood carbon dioxide, increases in epinephrine and other hormones associated with stress, and severe metabolic acidosis caused by high lactic acid levels. The rapid oxygen consumption triggers anaerobic glycolysis, which can significantly alter their acid-base balance (i.e., pH level of the blood), sometimes to lethal levels (Lutcavage and Lutz 1997). Recovery to pre-submergence lactate levels can take several hours (Stabenau and Vietti 2003) to as many as 20 hours (Lutz and Dunbar-Cooper 1987). 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 (Magnuson et al. 1990).

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

In the worst scenario, sea turtles 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 drowning occurs, sea turtles may become comatose or unconscious, generally unresponsive, and with a drastically suppressed heart and respiration rate – indicative of at least a physiological injury. If resuscitated per the sea turtle conservation regulations (50 CFR 223.206(d)(1)(B)), some of these sea turtles may recover and survive. However, sea turtles caught in such condition and returned to the water without resuscitation are presumed to die (Kemmerer 1989).

5.1.2 Potential Factors Affecting the Likelihood, Frequency, and/or Severity of Sea Turtle Exposure to Trawl Gear

Potential factors affecting the likelihood of a sea turtle being caught at any time can broadly be grouped as biological or technological. Biological factors include availability of sea turtles on fishing grounds, behavior towards the fishing gear, and the size, shape, and external features of the sea turtles. Some of these biological factors are dependent on the season, age, environment, and the species. Technological factors can include the gear type, design, size, material, and position, the duration of the sea turtle's exposure and nature and extent of its handling, and the experience of the fishermen. These factors can be dependent on biological changes.

The likelihood and frequency of sea turtle exposure to shrimp trawls is in large part a function of the extent of spatial and temporal overlap of each sea turtle species and fishing effort. Species' habitat preferences and the environmental conditions (i.e., water temperatures) may play a large part in the distribution and overlap of sea turtles and shrimp. In general, 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 likelihood and frequency that a sea turtle will be exposed to the gear.

Once a sea turtle is exposed to trawl gear, the likelihood of that interaction resulting in capture of the sea turtle and the extent of injury from its forced submergence and/or capture depends primarily on the type of trawl used, the amount of time towed, and whether or not the trawl is equipped with a properly installed TED. It is likely that the rapidity and extent of the physiological changes that occur during forced submergence are functions of the intensity of struggling underwater, as well as submergence time (Lutcavage and Lutz 1997). Other factors potentially 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. 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 too may play a role in increasing or reducing the survival rate of an entangled sea turtle (Lutcavage and Lutz 1997).

Site Fidelity of Sea Turtles

Shrimp trawling activity is aggregated and although use of neritic habitat by sea turtles is not well understood, in the northwest Atlantic, individuals of various sea turtle species appear to exhibit site fidelity, restricting their activities to preferred foraging areas. Immature hawksbills foraging on reefs have been found to inhabit areas ranging from 0.1-0.21 km^2 over an 11-16 day period (Van Dam and Diez 1998). Similarly, juvenile green turtles monitored using sonic telemetry for several months in inshore (Mendonça 1983) and nearshore (Makowski C et al. 2006) waters occupied home ranges between 0.48-5.06 km^2 (Mendonça 1983). Juvenile Kemp's ridley turtles followed using radio and sonic telemetry restricted their foraging activities to areas ranging from 5 to 30 km^2 (Schmid 2000; Schmid et al. 2003). The 10-80 km^2 foraging ranges estimated for juvenile loggerheads tracked using radio telemetry for 2-66 days (mean = 26.5 days) in a coastal bay are far larger than those found for other turtle species (Byles 1988). However, mark-recapture data indicate that juvenile loggerheads in sub-tropical and temperate areas do exhibit site fidelity, as turtles are often recaptured at specific locations within a given year, as well as between years, after having undergone seasonal migrations (Byles 1988; Avens and Lohmann 2003). During a mark-recapture study spanning four years, an average of 21 percent of loggerheads captured in Core Sound, North Carolina, and released near their capture locations were recaptured during the same year in which they were originally caught (Avens and Lohmann 2003). Furthermore, between 4 percent and 21 percent of juvenile loggerheads tagged in North Carolina within a given year were recaptured in subsequent years presumably after having migrated away from the capture area during winter months (Avens and Lohmann 2003). Similarly, 20 percent of loggerheads caught and tagged in the Chesapeake Bay were subsequently recaptured in the original capture area 1 to 11 years after release (Mansfield 2006).

Site fidelity, or a preference for a specific home range, can also be inferred by the tendency of animals to return to restricted areas after being displaced from those locations (Papi 1992). Such homing behavior suggests a strong predilection for a given site especially if the resources at that site can be found elsewhere in the habitat, such as near the areas in which the animals were released. Green turtles displaced from their feeding sites in Bermuda and followed using sonic telemetry exhibited a strong tendency to return to preferred feeding areas (Ireland 1980). Mark-recapture data show that juvenile loggerheads displaced from capture sites in sub-tropical and temperate areas will also return to their capture areas (Lutcavage and Musick 1985; Byles 1988). Over the course of a four-year study, 17 percent of juvenile loggerheads displaced 15-20 km from capture sites in the inshore waters of North Carolina were recaptured during the same year in the same general area in which they were originally captured (Avens and Lohmann 2003).

Relationship Between Tow Times And Mortality Rates And Seasonal Differences
Henwood and Stuntz (1987) published a linear equation showing a strong positive relation between shrimp trawl tow time and incidence of sea turtle death among the turtles observed captured aboard commercial shrimp trawlers using 1973-1984 data from three NMFS fishery observer programs. Henwood and Stuntz (1987) also estimated the overall percentage of sea turtles that might be expected to die in commercial shrimp trawls not equipped with TEDs, based on the average tow times determined in their study. For the Gulf of Mexico, the mortality estimate was 29 percent. For the Atlantic, the mortality estimate was 21 percent, reflecting shorter average tow times in the Atlantic.

The National Research Council (NRC) (Magnuson et al. 1990) revisited the NMFS data set used by Henwood and Stuntz to clarify the relationship between tow times and mortality. They concluded that "Death rates are near zero until tow times exceed 60 minutes; then they rise rapidly with increasing tow times to around 50 percent for tow times in excess of 200 minutes…Death rates never reach 100 percent because some turtles might be caught within 40 to 60 minutes of lifting the net from the water." The NRC also found significant seasonal differences in mortality rates associated with tow times within the dataset. In the summer, when respiratory demands are presumably greater at higher water temperatures, tow limits of about 40 minutes appeared necessary to ensure negligible mortality of captured sea turtles; in the winter tow times of about 90 minutes had equal effectiveness. The NRC expressed concern that Henwood and Stunz (1987), by assuming that all comatose turtles survived, had underestimated overall mortality estimates and that Henwood and Stunz's estimates could be low by as much as a factor of 3. The NRC also noted that if comatose sea turtles were considered as mortalities, winter tows would need to be restricted to 60 minutes or less instead of less than 90 minutes, but the 40- minute restriction in the summer would still be sufficient.

Epperly et al. (2002) re-analyzed the data set used by Henwood and Stuntz, following the NRC recommendations to consider all comatose turtles as dead and also to separately analyze winter and summer mortality. They developed a logistic regression model for the tow time-mortality response (as opposed to the linear model used by Henwood and Stuntz) and applied it to updated data sets of average tow times in the commercial shrimp fleet (c.f., 1997-2002 observer data in Epperly et al. vs. 1973-1984 observer data in Henwood and Stuntz), which were subdivided into 3 depth strata (inshore, nearshore and offshore) and 5 subregions (2 subregions in the Gulf of Mexico and 3 subregions in the Atlantic). Epperly et al. (2002) findings were consistent with and expanded on what was reported by Henwood and Stuntz (1987) and the NRC:

> Specifically, tows of short duration have little effect on mortality, intermediate tow times result in a rapid escalation to mortality, and eventually reach a plateau of high mortality.

Mortality will be high on long tows, but will not equal 100 percent as a sea turtle caught within the last hour of a long tow would likely survive.

The Epperly et al. (2002) reanalysis of the Henwood and Stuntz data produced mortality estimates by strata based on updated fishery information. The results are presented in Table 8. The proportion of sea turtles dying in each strata was computed by determining the mortality associated with each tow, based on the tow's duration and season, and weighted by the proportion of time represented by that tow to the total amount of time towed in a particular stratum. The proportion of animals retained in trawls that are likely drown based on tow durations from NMFS and Gulf and South Atlantic Fisheries Foundation sampling data are in bold. In the absence of data (normal type), it is assumed that the mortality rates in inshore waters are the same as nearshore (Gulf) or ocean waters (Atlantic) and that both the distribution of tow duration for the North subregion of the Atlantic, and the mortality rates are the same as for the central subregion of the Atlantic. Epperly et al (2002) provides additional information on the data sources, methods, and sources of error.

Table 8. Proportion of Animals Retained in Trawls that Likely Drown By Area Subregion, Depth and Season. (i.e., Table 24 in Epperly et al. 2002).

Area/Subregion	Depth Stratum	Season	
		Summer (March though November)	Winter (December through February)
Eastern GOM	Inshore	0.8899	0.9842
	Nearshore	**0.8899**	**0.9842**
	Offshore	**0.9351**	**0.9885**
Western GOM	Inshore	0.9146	0.9826
	Nearshore	**0.9146**	**0.9826**
	Offshore	**0.9588**	**0.9978**
Atlantic North	Inshore	0.7303	0.8537
	Ocean	0.7303	0.8537
Atlantic Central	Inshore	0.7303	0.8537
	Ocean	**0.7303**	**0.8537**
Atlantic South	Inshore	0.4055	0.9930
	Ocean	**0.4055**	**0.9930**

Most recently, Sasso and Epperly (2006) revisited the Henwood and Stuntz (1987) data analysis and concluded more specifically, “For both seasons, tows of short duration (<10 min) have negligible likelihood of sea turtle mortality [defined as 1 percent by (Henwood and Stuntz 1987) and (NRC 1990)], intermediate tow times resulted in a rapid escalation in mortality (10-200 min in summer and 10-150 min in winter), and eventually reached a plateau of high mortality.”

During 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; Lutcavage and Lutz 1997). However, Epperly et al. (2002) and Sasso and Epperly (2006) found the stress of being captured in a trawl to actually be greater in cold water than in warm water. Epperly and Sasso (2006) noted that perhaps the stress of lower water temperature on poikilotherms may result in reduced tolerance of forced submergence, citing Lutz and Dunbar-Cooper (1984) and Moon (1992) as evidence.

Effect of Species Composition, Age, and Size on Survival

In addition to time of day and temperature, respiratory demand for oxygen is expected to vary by body size and sea turtle species. 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. (1996) found that corticosterone concentrations of captured small loggerheads were higher than those of large loggerheads captured during the same season. Although NRC, in its review of Henwood and Stentz (1987) data, found no significant difference between loggerheads and Kemp’s ridleys or different life stages of loggerheads, we do believe it is probable that different sea turtle species and life stages have different physiological responses to lengthy forced submergence due to differing average body sizes and corresponding oxygen capacities. In the absence of species-specific estimates, however, the all-species mortality rates presented in Table 8 above represent the best available scientific information on which to base sea turtle mortality in trawls, not excluded by TEDs.

Effect of Legal TED Use on Sea Turtle Interactions, Captures, and Mortality

With its position just before the codend in trawl nets, the use of TEDs has no effect on the likelihood or frequency of interactions. TEDs do not serve as a physical or behavioral deterrent to sea turtles entering trawl nets. However, TEDs do dramatically reduce the likelihood of those interactions resulting in capture, mortality, or both. Documented capture rates in early TED testing based on paired otter trawl tows (i.e. one with a TED and one without) conducted on chartered shrimp vessels documented a 97 percent exclusion efficiency rate (NMFS 1981). Based on recent evaluation and testing of various TED designs, NMFS has determined that a perfectly installed and maintained TED will result in an approximately 95 to 98 percent turtle exclusion efficiency rate depending on turtle size (J. Gearhart memo to S. Epperly, NMFS, March 29, 2011); the lower efficiency rate was documented for smaller turtles used in NMFS’ small turtle testing protocol between 2001-2010, which relies on 2- to 3-year old juvenile turtles, while the higher efficiency rate was documented in NMFS’ wild turtle testing protocol between 2002-2007, which typically witnesses larger, adult turtles. Because Southeastern shrimp fisheries are prosecuted over a wide area and are more likely to interact with larger sea turtles on most shrimping grounds, we believe assuming a 97 percent exclusion efficiency rate is representative of the exclusion efficiency rate of compliant TEDs in the fleet as we did in NMFS (2002) is still appropriate.

The currently approved TEDs are capable of releasing all species and size classes of turtles. In trawls equipped with properly-functioning approved TEDs, sea turtles are able to escape quickly and avoid forced submergence. Generally, sea turtles are oriented forward when their backward progress toward the codend is stopped by the TED grid. After briefly exploring the area around the TED (usually searching upwards), the turtles will find the escape opening and turn to exit the hole head-first. The control TED used during TED testing trials from 1997 to 2000 (a top-opening, bent-bar TED, with a Gulf then-legal escape opening) had mean escape times for the captive-reared turtles ranging from 83 to 118 seconds. By comparison, the wild loggerheads encountering trawls equipped with the 71" opening TED or the double-cover TED (the TEDs required in offshore waters under the proposed action), had mean escape times of 31 seconds. Most turtles actually had a much quicker escape; the average is biased high by a couple of slower escapes; the median escape time was 19 seconds. Wild loggerheads encountering the 44" opening TED (the TED required for inshore use under the proposed action) had a slightly longer mean escape time of 46 seconds (30 seconds median escape time) (NMFS Pascagoula Laboratory 2002 and 2002a). Although the captive-reared and wild results are not directly comparable (the captive-reared escape times were measured from entering the trawl while the wild turtle escape times were measured from contact with the TED grid), these results suggest that sea turtles can escape from TEDs very quickly with the larger-opening TEDs implemented in 2002. Thus, escaping through large and properly-functioning TEDs represents a very brief period of forced submergence that is believed to have very little physiological effect on sea turtles.

Effects of Legal TED Exemptions
Trawls exempted from both TED use and tow times are limited to roller frame trawls. It is unlikely that a sea turtle would become entrapped within a roller frame trawl due to the required deflector bars positioned across the trawl mouth (Epperly et al. 2002), thus this exemption is not expected to have any adverse results on sea turtles. Tow-time requirements for vessels currently exempted from TED use are expected to further reduce effects to the extent that they are complied with. The sea turtle conservation regulations specify that, for those limited circumstances where shrimpers may comply with tow time limits instead of using TEDs, tow times be limited to 55 minutes from April through October and to 75 minutes from November through March (50 CFR 223.206(d)((3)). These regulations were based on the NRC findings that sea turtle death rates in trawls are near zero until tow times exceed 60 minutes. The regulatory tow time limits include a 15 minute allowance for setting and retrieving gear, since the NRC analysis of tow times looked at bottom time only.

Effects of Other Sea Turtle Conservation Regulations
The sea turtle conservation regulations also require fishermen to attempt to resuscitate comatose sea turtles (50 CFR 223.206(d)(1)(B)) before returning them to the water. Fishing in compliance with the sea turtle conservation regulations since 2002 likely has resulted in fewer sea turtles caught in need of resuscitation. In cases where sea turtles are comatose from capture, these regulations allow for some of these turtles to recover and be released alive with increased chances of survival. It is unclear to what extent shrimp fishermen comply with the resuscitation

requirements. Despite NMFS and state outreach, anecdotal reports suggest that many fishermen return caught sea turtles to the water immediately because they fear there may be consequences of having a listed sea turtle on deck.

Effects of TED Efficiency and Release Rates

Many factors of TED construction and installation affect the TED's efficiency (whether and how fast it excludes turtles). When TEDs are not properly functioning, the length of time to escape will be adversely affected and even the ability to escape at all may be compromised, depending on the extent of the malfunction and/or violation.

Two issues of great concern are TEDs with excessively steep grid angles (i.e., installed at angles above the 55-degree maximum angle) and escape openings with insufficient measurements (i.e., less than the required minimum measurements). Steep TED-grid angles are of particular concern to small, juvenile sea turtles, as TED testing by NMFS has documented even small variances above the 55-degree maximum angle will prevent sea turtles from escaping the net. In contrast, escape openings with insufficient measurements will prevent larger, adult sea turtles from escaping the net. Aside from these two critical issues, a host of other discrepancies with TED requirements, including excessive overlap of double-cover escape opening panel flaps, bar spacing in excess of the 4-inch maximum, improper flotation, excessive escape panel flap length beyond 24 inches, and other technical issues may occur and have some effect. While these issues do not represent as significant a threat as steep TED angles and insufficient escape openings, they still can hinder turtle escapement from a trawl net. Non-compliant TEDs sometimes have multiple problems, which probably act in concert to further worsen the chances of a sea turtle escaping.

Effect of Multiple Captures

Sea turtles may interact with trawls more than once. Epperly et al. (2002) addressed the potential for multiple captures of the same sea turtles under the assumptions that shrimp trawlers tend to work the same areas and that a proportion of sea turtle populations would remain in the area. Epperly et al. (2002) noted that, based on recapture studies, it appears that at least 20 percent of the turtles involved in non-lethal interactions subsequently will be recaptured. Newer information is generally consistent with the older information with the exception that there is some indication recapture probability may differ among locations. In 2011 SEFSC worked with SCDNR to design a study to resample a subset of trawl stations in an attempt to recapture turtles and analyze the mark-recapture data. The study using a single vessel was unsuccessful in recapturing any sea turtles, although this methodology may not be representative of a sea turtles's exposure to capture by multiple vessels in the shrimp fleet. Shrimp fishing is often congregated in relatively small areas to target high densities of shrimp. The issue of multiple captures is reduced as compliance decreases, as a greater proportion of the interactions might result in mortalities and sea turtles would not be released alive to be recaptured again.

Lutcavage and Lutz (1997) noted sea turtles are probably more susceptible to lethal metabolic acidosis if they experience multiple forced submergence events in a short period because they would not have had time to process lactic acid loads. Presumably, a sea turtle recovering from a forced submergence would remain resting on the surface (given it had the energy stores to do so), which would reduce the likelihood of it being recaptured by a trawl while recovering (see Section 5.0 discussion) for analysis of related potential indirect effect from recovering at the surface. Recapture would also depend on the condition of the sea turtle and the intensity of fishing pressure in the area.

Stabenau and Vietti (2003)studied the physiological effects of multiple forced submergences in loggerhead turtles. The initial submergence produced severe and pronounced metabolic and respiratory acidosis in all turtles. Successive submergences also produced significant changes in blood pH, CO2, and lactate, but as the number of submergences increased, the acid-base imbalances were substantially reduced relative to the imbalance caused by the first submergence. Increasing the time interval between successive submergences resulted in greater recovery of blood homeostasis. The authors conclude that repetitive submergences of sea turtles in TED-equipped nets would not significantly affect their survival potential so long as sea turtles have a long enough recovery interval at the surface between submergences.

In the 2002 opinion, we discussed how repeated captures in a short time period could contribute to sea turtle mortality, but there was little data to assess the extent to which multiple captures were occurring and whether they were having adverse effects on sea turtles. We noted that the most compelling information of a link between multiple captures during a short period of time and increased mortality was evidence of continued correlation of shrimp fishing effort with sea turtle strandings post-implementation of TEDs, citing examples of elevated strandings during high shrimp effort times (e.g., 67 FR 37723, May 30, 2002). We also pointed out that Epperly et al. (2002) estimated at least 20 percent of the sea turtles involved in non-lethal interactions subsequently would be recaptured under the then current regulations.

With highly efficient TEDs, like the 71" TED and double-cover TED now required, and TED escape times of around 30 seconds, it is difficult to assign significant physiological risk to repeated captures. With the declines in effort in shrimp fisheries dicussed in Section 2, which have occurred since 2001, the densities of trawlers on shrimp grounds have likely declined by a similar amount. Therefore, we believe the risk of repeated captures is probably much lower now than in 2001. A significant unknown is a turtle’s energy expenditure that might be associated with trying to outrun a trawl, before even encountering the TED. No data exist to quantify the extent of the effect.

5.1.3 Extent of Effects on Sea Turtles from Otter Trawls

In this section, we attempt to address the question of how many sea turtles are adversely affected by otter trawls. We start by reviewing the bycatch estimation methods used in NMFS (2002) (Section 5.1.3.1). Next, we summarize new information relevant to the bycatch analysis since 2002 (Section 5.1.3.2). Last, we describe recent efforts to update the 2002 otter trawl bycatch estimates based on the new information.

5.1.3.1 Review of NMFS (2002) Bycatch Estimation Methods

In the 2002 opinion, we reviewed all available data sets that included sea turtle CPUE data and considered their ability to best represent actual shrimp otter trawl fishing and its impacts on sea turtles. We ultimately used the following four data sets as the basis for sea turtle interaction estimations, at least for some species and areas:

- Henwood and Stuntz (1986; 1987) data set based on commercial shrimp trawler observations in the Gulf and Atlantic, 1973-1984
- Gulf and South Atlantic Fisheries Foundation (Foundation 1998; Jamir 1999) data set based on commercial shrimp trawler observations, vessels not using TEDs, 1997-1998
- South Carolina Department of Natural Resources (SCDNR) sea turtle abundance data sets, based on research trawl sea turtle captures in the Atlantic only, 2000 and 2001, separately (Whitaker et al., unpublished data)
- STSSN hawksbill stranding data, 1999-2001

Of these data sets, the Foundation data were, on balance, determined to be the most representative of the southeastern shrimp trawl fisheries resulting from fishery-dependent sampling (i.e., the shrimp captains selected the trawling sites, based on shrimp catches) in the Gulf and the Atlantic and used to estimate interactions for leatherback, loggerhead, Kemp's ridley, and green sea turtles. SCDNR data sets were used to produce sea turtle catch estimates in the Atlantic, for comparative purposes only, as they are fairly robust in terms of turtle sample size, even though they do not represent effort in the commercial shrimp fishery. Last, none of those data sets included captures of hawksbills, so strandings data were used for estimating hawksbill interactions. NMFS (2002) provide more detailed information regarding advantages and shortcomings of each data set.

Sampling gaps in the CPUE data sets and incompatibilities between reporting of turtle CPUE and shrimp fishery effort resulted in us then applying a number of different analyses to the different data sets listed above to identify the best available estimation method for each species, across all areas. Ultimately, we relied mainly on analyses of Epperly et al. (2002). For our loggerhead and leatherback sea turtle estimates, we adopted the estimation methods and results contained in Epperly et al. (2002) which used CPUE recalculated from Foundation 97-98, adjusted for aerial surveys and 2001 effort data (NMFS 2002). Epperly et al. also provided interaction, capture, and mortality estimates for green and Kemp's ridley sea turtles using the same methods as just described. However, the authors cautioned that its application of the aerial survey adjustment to CPUEs for these species might be especially inaccurate because of sightability problems associated with their smaller size and cryptic coloration relative to loggerheads and leatherbacks and introduction of bias from the distribution of the sightings (i.e., neither species were sighted in the Atlantic or Northern Gulf). Therefore, because the estimates produced using the aerial survey adjustment did not seem credible for Kemp ridley and green sea turtles, we used the estimation methods of Epperly et al. but with the CPUEs recalculated from Foundation 97-98 data without the aerial survey adjustment and then calculated new results. For hawksbill sea turtles, with no CPUE data at all, an expansion of the strandings data was the only estimation method available to us. More detailed discussion of the 2002 data sources, calculation methods, constraints of those methods, and the assumptions under which those calculations were made are included in Epperly et al. (2002) and NMFS (2002)and are incorporated by reference.

5.1.3.2 Summary of New Information Relevant to Bycatch Analysis Since 2002

- Decreases in Shrimp Otter Trawl Effort

Our 2002 opinion analysis was based on 2001 otter trawl fishing effort levels and the expectation that otter trawl fishing effort would remain at that level in the future. However, as presented and discussed in Section 2, data collected since 2001 indicate otter trawl effort has decreased dramatically since then. On January 5, 2011, the SEFSC provided us with 2009 otter effort data for both the Gulf and South Atlantic, along with updated bycatch estimates for loggerhead and leatherback sea turtles based on that data. On September 14, 2011, SEFSC provide us with the corrected effort data for the Gulf of Mexico after discovering that it had been stratified inconsistently with Epperly et al. (2002). Future otter trawl effort levels are expected to remain at or below 2009 levels.

- Substantial Increases in Kemp's Ridley and Green Sea Turtle Abundance Since 1997/1998

In Section 3 we presented available information on sea turtle population abundance and trends by species. Of the five sea turtle species that the southeastern shrimp trawl fisheries interact with, the Kemp's ridley sea turtle and green sea turtle populations have experienced significant increases since the late 1990's. Based on new model results, the Kemp's ridley population has been increasing 19 percent annually since 1997 (NMFS et al. 2011). Population models (Heppell et al. 2005) predict the Kemp's ridley population will grow at least 12-16 percent per year, (19 percent based on updated model in NMFS et al. 2011), for the near future, assuming current survival rates within each life stage remain constant. Green sea turtle populations have also grown significantly. Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Tortuguero, Costa Rica, population growing at 4.9 percent annually. Some other nesting assemblages (e.g., Florida) exhibited even higher annual growth. In this opinion, however, we will focus on the 4.9 percent seen at Tortuguero because that rookery is the largest in the Atlantic and has the strongest effect on the overall population of green sea turtles in the Northwest Atlantic.

- Elevated Sea Turtle Stranding in 2010 and 2011

Over the past two years NMFS has documented elevated sea turtle strandings in the Northern Gulf of Mexico, particularly throughout the Mississippi Sound area. In the first three weeks of June 2010, over 120 sea turtle strandings were reported from Mississippi and Alabama waters, none of which exhibited any signs of external oiling to indicate effects associated with the DWH oil spill event. A total of 616 sea turtle strandings were reported in 2010 from Louisiana, Mississippi, and Alabama waters, 526 (85 percent) of which were Kemp's ridley sea turtles. During March through May of 2011, 240 sea turtle strandings were reported from Mississippi and Alabama waters alone. A total of 461 sea turtle strandings were reported from January through July 2011 from Louisiana, Mississippi, and Alabama waters, 388 (84 percent) of which were Kemp's ridley sea turtles. These stranding numbers are significantly greater than reported in past years (i.e., Louisiana, Mississippi, and Alabama waters reported 42 and 73 sea turtle strandings for 2008 and 2009, respectively); however, it should be noted that stranding coverage has increased considerably due to the DWH oil spill event (See Section 2.1.2 of the DEIS for more details). Necropsy results indicate a significant number of stranded turtles from both the 2010 and 2011 events likely perished due to forced submergence, which is commonly associated with fishery interactions (B. Stacy, NMFS, pers. comm.).

Based on the available information, potential explanations or scenarios for the elevated sea turtle strandings include the following, either individually or in concert: (1) increased sea turtle strandings are an artifact of increased Sea Turtle Stranding and Salvage Network (STSSN) effort, and sea turtle strandings have not substantially changed in the past few years; (2) increased sea turtle strandings are due to undocumented/undetermined effects of the DWH oil spill event; (3) increased sea turtle strandings are a result of increased sea turtle abundance (i.e., Kemp's ridley sea turtles) based on increased nesting numbers; (4) increased sea turtle strandings are due to incidental bycatch in the shrimp fishery stemming from poor compliance with TED requirements and/or alternative tow time restrictions; and/or (5) increased sea turtle strandings are a result of some other unknown cause.

- Implementation of Mandatory NMFS Shrimp Observer Coverage

NMFS implemented mandatory observer coverage for federally-permitted shrimp trawls in July 2007 in the Gulf of Mexico and in June 2008 in the South Atlantic. Texas and Louisiana make up the most highly sampled area with selection of boats based on the previous year's landings, and coverage levels are approximately two percent of directed effort.

Although many methods may contribute to useful bycatch estimation programs, at-sea observation (observers or electronic monitoring) combined with logbook effort data typically provides the best mechanism to obtain reliable and accurate bycatch estimates for fisheries (NMFS 2004). However, the existing shrimp observer data have an insufficient number of observed sea turtle captures per strata [as defined in (Epperly et al. 2002)] to provide an unbiased estimate. This is because (at least in part) TEDs properly used in otter trawls result in the release of the vast number of sea turtles underwater where they are unobservable. Even some of the sea turtles that fail to escape through the TED can go undocumented. This event is more likely to occur with high-angle (>55 degrees) TED violations, where turtles can become impinged on reflector bars due to waterflow against the carapace, particularly juveniles which have less strength to overcome drag. This pressure is reduced at haulback, allowing some impinged animals to slide off the grid and out of the TED opening, particularly in bottom-opening TEDs. While these "ghost captures" (i.e., captures that are less likely to occur with top-opening TEDs, SEFSC gear specialists have observed large-frame (>48) top-opening TEDs without flotation rolling over (inverting) at the surface which could also result in turtles falling out of the opening even in top-opening TEDs. In addition, some of the captured sea turtles may fall out of the front of the net as the lazy line is used to haul up the codend of the net. These sea turtles may or may not be observed depending on conditions (e.g., high sea state or at night) and where the observer is positioned aboard the vessel.

Murray et al. (2011) provide a framework for characterizing total protected species interactions as observable (those animals that are brought on board or observed) and unobservable (animals that interact with the gear exclusively subsurface or away from view) and describes how in some cases inferences can be made to estimate at least a portion of the unobservable bycatch. At this time, there are insufficient data for estimating unobserved captures in shrimp fisheries in such manner.

- Sea Turtle Conservation Regulatory Compliance Expectations

When the 2002 opinion was drafted, regulatory compliance expectations were high based in part on relatively new agreements with the states to assist in enforcing TED requirements. Thus, in the 2002 opinion, we assumed a 100 percent compliance with the TED regulations and that only 3 percent of sea turtle interactions would result in capture (TEDs being 97 percent effective at releasing sea turtles) consistent with Epperly et al. (2002). However, over the past couple of years, we have collected data documenting compliance problems, causing us to re-evaluate our previous assumption and our future expectations on TED compliance and resulting sea turtle capture rates. NMFS gear specialists and law enforcement officers, during numerous evaluations conducted in the Southeast region, documented a variety of compliance issues including lack of TED use, TEDs sewn shut, TEDs installed improperly, and TEDs being manufactured that do not comply with regulatory requirements. As explained in Section 5.1.2, when TEDs are not installed and used per the legal specifications, the length of time to escape will be longer and, depending on the extent of the malfunction, escape can be prevented entirely. Two issues of great concern are TEDs with excessively steep grid angles (i.e., installed at angles above the 55-degree maximum angle) and escape openings with insufficient measurements (i.e., less than the required minimum measurements). Steep TED-grid angles are of particular concern to small, juvenile sea turtles, as TED testing by NMFS has documented even small variances above the 55-degree maximum angle will prevent sea turtles from escaping the net. In contrast, escape openings with insufficient measurements will prevent larger, adult sea turtles from escaping the net. Aside from these two critical issues, NMFS has also noted a host of other discrepancies with TED requirements, including excessive overlap of double-cover escape opening panel flaps, bar spacing in excess of the 4-inch maximum, improper flotation, excessive escape panel flap length beyond 24 inches, and other technical issues. While these issues do not represent as significant a threat as steep TED angles and insufficient escape openings, they still can hinder turtle escapement from a trawl net.

Cox et al. (2007) compared the effectiveness of experimental and implemented bycatch reduction measures by evaluating pre-implementation experimental measures and post-implementation efficacy from primary and grey literature for three case studies: acoustic pingers warning marine mammals of the presence of gillnets, TEDs that reduce bycatch in trawls, and various measures to reduce seabird bycatch in Pacific longlines. They concluded that transferring the efficacy of bycatch reduction measures from experimental field trials to operational fisheries has had varying degrees of success and that there were three common themes to successful implementation of bycatch reduction measures: (1) long-standing collaborations among fishing industry, scientists, and resource managers; (2) pre-and post-implementation monitoring; and (3) compliance via enforcement and incentives. Successful implementation depended on continued communication, education, and outreach through implementation studies. Post implementation monitoring was found to be critical for understanding why mitigation measure may lose effectiveness in operational fisheries. Cox et al. (2007) also pointed out how compliance depended heavily on enforcement, incentives, or both. Potential loss of fishing access was noted as a strong incentive. Compliance was facilitated by temporary or potential closures.

With the 2002 revisions to the sea turtle conservation regulations applicable to TEDs now in effect for over 8 years, we now have data that can be used to try to predict future compliance rates. Appendix 4 documents the extensive education, training, and outreach conducted by

NMFS since 2003. Based on our experience, while NMFS' TED education and outreach have certainly been an important part of the TED program and contributed to its successes, effective enforcement is still necessary to achieve compliance. Below we provide (1) a qualitative summary of the best available information on compliance and enforcement and how compliance appears to have fluctuated over the years since the 1980s in correlation with enforcement efforts, and (2) a quantitative analysis of compliance data from vessel boardings and associated TED effectiveness rates. We then discuss expected future compliance rates based on that information.

1980s-2002

In the 1980s, with the varying regimes of voluntary compliance and suspended enforcement, TED compliance was almost non-existent, but ultimately responded to increased enforcement through the early 1990s. By 1994, compliance was greatly improved, in the sense that virtually all shrimpers had TEDS installed, but the 1994 opinion determined that shrimpers' incorrect installation and improper use of TEDs was the major apparent cause of Kemp's ridley mortality at a level that led to a jeopardy finding. The RPA in that opinion included three major components, one of them being to improve TED regulation compliance. NMFS subsequently implemented numerous improvements to the overall enforcement regime, including expanded TED technical training programs to fishermen; TED technical training programs for NMFS Office of Law Enforcement (OLE), U.S. Coast Guard (USCG), and state law enforcement officers; the creation of specially-trained and quickly-deployable teams of OLE special agents and enforcement officers to deal specifically with TED compliance, through both proactive policing and crisis response; the use of the NMFS TED teams to patrol inshore and nearshore waters, where USCG resources had traditionally not been used; the inclusion of gear technicians in NMFS TED boarding teams, to maximize positive information exchange with fishermen and to identify and correct technical difficulties in the field; and the development of Joint Enforcement Agreements (JEAs) with most of the southeast states, under which state enforcement officers can take on the responsibilities for enforcement of federal regulations, including the TED requirements. In the 2002 opinion, we noted how the programs have greatly improved the effectiveness of TED enforcement since 1994 and successfully increased compliance in the fishery.

2003-2010

With the USCG's increase in resources dedicated to the at-sea fisheries mission, OLE referred the majority of at-sea TED enforcement in the Gulf of Mexico to USCG units. However, after the September 11, 2001, terrorist attacks, the USCG's prominent mission became national security, and it thus had fewer resources for maritime stewardship enforcement. The dedicated NOAA uniformed Protected Resource Enforcement Team (PRET) was ultimately phased out due to several factors such as budget and retention difficulties. Special Agents trained in approved TED construction specifications were then utilized to conduct TED inspections during periods of high shrimp trawl concentrations and higher strandings.

Although state JEA partners have provided the greater part of the TED enforcement effort, OLE agents continued to conduct patrols during critical periods (i.e., shrimp fishery openings, elevated strandings and in states where the JEA did not exist or did not include TED enforcement).

Based on state boarding statistics and cases submitted for prosecution, the JEA patrols were providing a deterrent and the perception was TED compliance was high (Table 9). However, the Gear Monitoring Team (GMT) from the Pascagoula Lab and Southeast Region personnel conducted a series of compliance inspections in Texas, Louisiana, Florida, and Georgia in July and August of 2010 which indicated serious compliance problems. The reports submitted by the group concluded the past and current enforcement efforts by all three agencies involved in TED enforcement (USCG, OLE, and states) had not been sufficient to compel TED compliance within the shrimping community. There were also concerns that that the USCG's competing missions interfered with fisheries enforcement and the State JEAs were not always adequate due to various restrictions imposed by states. Of particular concern, Louisiana enforcement officers were not permitted by Louisiana law to enforce the TED regulations. Also Texas law enforcement officers were only permitted to conduct TED enforcement within state waters.

Table 9. 2008-2010 JEA Observed Compliance Rates

Year	Commercial Boardings	WARNINGS		CITATIONS		Observed Compliance Rate (%)
		Federal	Federal/ State	Federal	Federal/ State	
2008	598	0	0	2	0	99.67
2009	1594	0	4	8	0	99.50
2010	1149	5	13	3	26	97.48

Most Recent Compliance Information

Starting in late March 2011, in response to elevated strandings of sea turtles documented along the Mississippi coast, OLE reprioritized its enforcement personnel to concentrate on conducting TED inspections with the GMT off of Louisiana and Mississippi in order to determine the influence shrimping effort had on the increased strandings. At the beginning of the increased enforcement effort, reports from aerial surveys indicated there were very few shrimpers working, so most of the focus was dockside. Enforcement personnel found the fleet was just beginning to gear up with only a few vessels doing test drags, and no evidence was found showing the skimmer trawl fleet had been active.

Although enforcement observations during the initial weeks of the increased inspection effort indicated the majority of the shrimp vessels had new TEDs aboard which had not yet been used in trawling operations, nearly all of the TEDs inspected had compliance issues. Investigation traced many of the non-compliant TEDs back to specific net shops. GMT and enforcement personnel conducted site visits to the net shops in question to provide corrections. Thus, although very low TED compliance was documented, the discovery of the non-compliance prior to the fleet starting shrimp fishing en masse potentially averted more sea turtle deaths.

OLE has maintained increased enforcement effort levels with additional enforcement personnel being brought into the Northern Gulf area to support the operation. Observed compliance and the severity of the violations appear to have improved as a result of the increase in TED inspections and the active role by OLE as evidenced by the number of vessels boarded versus the number of vessels with a TED out of compliance, regardless of severity through August (Table 10). In May 2011, after the initial enforcement effort to contact as many vessels as possible, the compliance rate as observed dockside and at-sea was approximately 56 percent. Observed compliance estimates rose to approximately 62 percent in June, and 68 percent in July. After peaking in August, overall compliance levels have declined again, but the violations documented have been increasingly minor infractions.

Table 10. May Through November 2011 Observed Compliance Rates

Month	Vessels Inspected For TED Compliance	Violations		Observed Compliance Rate
		Yes	No	
May	39	18	21	53.85%
June	133	51	82	61.65%
July	99	32	67	67.68%
August	61	9	52	85.25%
September	90	22	68	75.56%
October	96	41	55	57.29%
November	33	15	18	54.55%
May-November Combined	551	188	363	65.88%

Quantitative Analysis of Vessel Boarding Data and Associated TED Effectiveness

To better analyze the extent and impact of compliance levels and to account for the effect of TED violations on sea turtle capture rates, we conducted a quantitative analysis of compliance boarding data. Our analysis was organized into three main steps.

First, we calculated overall compliance and non-compliance rates in the Gulf of Mexico and South Atlantic region based on vessel boarding data from TED inspections. For our Gulf of Mexico compliance analysis we calculated monthly and overall average rates based on OLE May through November 2011 vessel boarding data (see Table 10 above). As there was no comparable data pool for the South Atlantic region during that time period (i.e., there were too few South Atlantic OLE boardings), we calculated annual and average compliance rates during the period 2006-2011 as documented mainly by boarding data provided by GDNR, which included compliance checks done on their own where standardized boarding forms were used, as well as those done in conjunction with OLE (Table 11). Additional boarding data from OLE inspections in the South Atlantic region conducted during December 2011 were also included in the analysis.

The second step was to assess the extent that the documented monthly, annual, and overall average noncompliance rates impacted sea turtle capture rates (i.e., TED effectiveness). Boarding records which had one or more violations and sufficient violation details to evaluate their impacts on capture rates were evaluated by SEFSC gear experts. SEFSC gear experts identified the most egregious violation from each boarded vessel by TED component (e.g., TED grid angle, escape opening dimension, escape flap configuration, etc.) and then assigned a level of severity (i.e., a 3, 10, 30, 50, 60, 70, 80, 90 or 100 percent probability of capture) relative to turtle size. For example, a TED angle of 65 degrees was scored as having a 90 percent probability of capturing a juvenile turtle and a 60 percent probability of capturing an adult. Conversely, escape opening dimensions that were less than the required minimum or more than the required maximums were assigned lower probabilities of capturing juvenile turtles and higher probabilities for adults; for example, a double-cover escape opening with a 52- to 54-inch leading edge cut (56-inch minimum) was scored as having an 80 percent probability of capturing an adult turtle but only a 10 percent probability of capturing a juvenile (Excel attachment to February 18, 2012 email from John Mitchell, NMFS SEFSC, to Jennifer Lee, NMFS SERO). A 3 percent capture rate was applied for technical minor violations that were unlikely to increase sea turtle capture rates. Capture probabilities were derived from the following: TED testing observations during which juvenile loggerheads were exposed to various configurations of non-compliant TEDs, TED testing (diver-assisted) assessments of a leatherback model passing through non-compliant TED configurations, and expert opinion of SEFSC gear technicians. Probabilities of capture were applied to one of two size-groups of turtles which are encountered in the shrimp fishery – either juveniles of loggerhead and green sea turtles, and all Kemp's ridley sea turtles (i.e., small-size group), or adult loggerhead and green sea turtles, and all leatherback sea turtles (i.e., large-size group). Weighted average capture rates for monthly, annual, and average noncompliance rates were also calculated. The results are presented in Tables 12-15.

The third step involved combining the overall documented compliance rates (step 1) with our capture rate analysis (step 2) to produce estimates of overall documented capture rates, again by month, annual, and overall (total) average. We accomplished this by applying the following equation: [percent fully compliant]*[a capture rate of fully compliant vessels of 3/100] + [percent non-compliant] * [weighted average capture rate of non-compliant vessels] = overall documented capture rate. The results are presented in Tables16 and 17.

Table 11. South Atlantic Compliance Levels

Data Provided By GADNR					
Year	**Number of Inspected Vessels Required to Have TEDs**	**Number of Inspected Vessels Required to Have TEDs That Were Found In Violation**	**Number of Inspected Vessels Required to Have TEDs That Were Fully Compliant**	**% of Vessels Inspected That Were Found Fully Compliant TEDs**	**% of Vessels Inspected Found Non-compliant**
2006	13	7	6	46.15%	53.85%
2007	27	17	10	37.04%	62.96%
2008	15	4	11	73.33%	26.67%
2009	4	2	2	50.00%	50.00%

2010	14	11	3	21.43%	78.57%
2011	40	27	13	32.50%	67.50%
TOTAL:	113	68	45	39.82%	60.18%

Table 12. Estimated Capture Rates for Small Turtles (Kemp's Ridleys and Juvenile Loggerhead and Green Sea Turtles) in the Gulf of Mexico in Non-Compliant TEDs

Capture Proba-bilities	May (n=9)		June (n=44)		July (n=20)		August (n=9)		September (n=18)		October (n=41)		November (n=15)		All Months Combined	
%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
3	0	0.00	8	18.18	6	30.00	5	55.56	6	33.33	25	60.98	8	53.33	58	37.18
10	2	22.22	5	11.36	2	10.00	1	11.11	2	11.11	3	7.32	2	13.33	17	10.90
30	0	0.00	2	4.55	1	5.00	0	0.00	2	11.11	2	4.88	0	0.00	7	4.49
50	0	0.00	3	6.82	0	0.00	1	11.11	2	11.11	4	9.76	0	0.00	10	6.41
60	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00%	0	0.00	0	0.00	0	0.00
70	2	22.22	9	20.45	2	10.00	1	11.11	3	16.67	2	4.88	3	20.00	22	14.10
80	0	0.00	3	6.82	0	0.00	0	0.00	1	5.56%	0	0.00	0	0.00	4	2.56
90	4	44.44	8	18.18	6	30.00	1	11.11	0	0.00	3	7.32	0	0.00	22	14.10
100	1	11.11	6	13.64	3	15.00	0	0.00	2	11.11	2	4.88	2	13.33	16	10.26
Weighted Ave (%)		68.89		56.2		52.4		26.1		38		23.8		30.27		42

Table 13. Estimated Capture Rates for Large Sea Turtles (Leatherback and Adult Loggerhead and Green Sea Turtles) in the Gulf of Mexico in Non-compliant TEDs

Capture Proba-bilities	May (n=9)		June (n=44)		July (n=20)		August(n=9)		September(n=18)		October (n=41)		Novembe r (n=15)		All Months Combined	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
3	0	0.00	8	18.18	6	30.00	5	55.56	6	33.33	25	60.98	8	53.33	58	37.18
10	0	0.00	3	6.82	0	0.00	1	11.11	2	11.11	4	9.76	0	0.00	10	6.41
30	2	22.22	9	20.45	2	10.00	1	11.11	3	16.67	3	7.32	3	20.00	23	14.74
50	0	0.00	4	9.09	0	0.00	0	0.00	1	5.56	1	2.44	0	0.00	6	3.85
60	4	44.44	8	18.18	6	30.00	1	11.11	0	0.00	3	7.32	0	0.00	22	14.10
70	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
80	2	22.22	6	13.64	2	10.00	1	11.11	2	11.11	2	4.88	2	13.33	17	10.90
90	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
100	1	11.11	6	13.64	4	20.00	0	0.00	4	22.22	3	7.32	2	13.33	20	12.82
Weighted Ave (%)		62.22		47.4		49.9		21.7		41		21.8		31.6		38

Table 14. Estimated Capture Rates for Small Turtles (Kemp's Ridleys and Juvenile Loggerhead and Green Sea Turtles) in the South Atlantic in Non-Compliant TEDs

Capture Proba-bilities	2006 (N=8)		2007 (N=17)		2008 (N=4)		2009* (N=2)		2010 (N=11)		2011 (N=27)		All Years	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
3	3	37.50	2	11.76	1	25.00	2	100	0	0.00	10	37.04	18	26.09
10	0	0.00	0	0.00	1	25.00	0	0	0	0.00	4	14.81	5	7.25
30	0	0.00	1	5.88	0	0.00	0	0	0	0.00	3	11.11	4	5.80
50	2	25.00	2	11.76	1	25.00	0	0	0	0.00	1	3.70	6	8.70
60	0	0.00	0	0.00	0	0.00	0	0	0	0.00	0	0.00	0	0.00
70	0	0.00	3	17.65	1	25.00	0	0	4	36.36	2	7.41	10	14.49
80	0	0.00	0	0.00	0	0.00	0	0	1	9.09	0	0.00	1	1.45
90	3	37.50	8	47.06	0	0.00	0	0	3	27.27	5	18.52	19	27.54
100	0	0.00	1	5.88	0	0.00	0	0	3	27.27	2	7.41	6	8.70
Weighted Ave (%)		47.38		68.6		33.25				85		37		52.38

*In 2009, there were only two boardings with sufficient information to assess estimated capture rates therefore the annual capture probabilities are too biased by the small sample size to consider on their own. The two records are included in the "all years" summary.

Table 15. Estimated Capture Rates for Large Sea Turtles (Leatherback and Adult Loggerhead and Green Sea Turtles) in the South Atlantic in Non-compliant TEDs

Capture Proba-bilities	2006 (N=8)		2007 (N=17)		2008 (N=4)		2009* (N=2)		2010 (N=11)		2011 (N=27)		All Years	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
3	3	37.50	2	11.76	1	25.00	2	100	0	0.00	10	37.04	18	26.09
10	1	12.50	2	11.76	0	0.00	0	0	0	0.00	2	7.41	5	7.25
30	0	0.00	3	17.65	1	25.00	0	0	4	36.36	2	7.41	10	14.49
50	0	0.00	0	0.00	0	0.00	0	0	1	9.09	0	0.00	1	1.45
60	3	37.50	8	47.06	0	0.00	0	0	3	27.27	5	18.52	19	27.54
70	0	0.00	0	0.00	0	0.00	0	0	0	0.00	0	0.00	0	0.00
80	0	0.00	1	5.88	1	25.00	0	0	0	0.00	5	18.52	7	10.14
90	0	0.00	0	0.00	0	0.00	0	0	0	0.00	0	0.00	0	0.00
100	1	12.50	1	5.88	1	25.00	0	0	3	27.27	3	11.11	9	13.04
Weighted Ave (%)		47.38		68.6		33.25		3		85		37		52.38

Table 16. Overall 2011 May through November Capture Rates By Size Class in the Gulf of Mexico

Size Class	May	June	July	August	September	October	November	All Months Combined
Small Sea Turtles	33.41	23.41	18.97	6.41	11.61	11.88	15.39	16.18
Large Sea Turtles	30.33	20.01	18.16	5.75	12.29	11.04	16.00	14.98

Table 17. Overall 2006-2011 Annual Capture Rates By Size Class in the South Atlantic

Size Class	2006	2007	2008	2009	2010	2011	All Years
Small Sea Turtles	26.89	44.30	11.07	3.00	67.07	25.98	32.71
Large Sea Turtles	21.51	29.85	16.40	3.00	47.07	28.73	27.83

Based on our analysis, overall capture rates improved greatly in the Gulf of Mexico with increased enforcement and outreach activities between May and November 2011. While individual violations have markedly different capture rates for small and large sea turtles, overall monthly capture rates in the Gulf of Mexico were similar. The overall average capture rate over the period is driven down by the first three months. Average capture rates, were approximately 33 percent in May, but then dropped by approximately 30 percent by June for both size classes and then another 10 percent for large sea turtles and 17 percent for small sea turtles by July. In August, compliance peaked and capture rates were approximately 6 percent. While captures rates did increase some during September through November, between August through November, the fleet still maintained capture rates below 12 percent.

In the South Atlantic, where enforcement has not been as high a priority in recent years and thus not as extensive, compliance and associated capture rates have fluctuated from year to year, with the worst compliance documented in 2010 and the best compliance documented in 2011.

Anticipated Future Compliance Rates

Based on the qualitative and quantitative information above, it is unrealistic to assume the otter trawl shrimp fleet has ever achieved 100 percent compliance with the sea turtle conservation regulations or that it will in the future. Despite investing a lot of resources in outreach, education, and training since 2003, it appears compliance remains strongly correlated with the level of enforcement efforts. Based on analysis of documented compliance rates, the extent of violations, and the effect different TED violations have on capture rates in trawls, both the number and severity of regulatory violations play a major role in how successful the sea turtle conservation regulations are. Thus, NMFS is now proposing to monitor and ensure compliance with the sea turtle conservation regulations at a level that would keep sea turtle catch rates of shrimp trawls required to use TEDs at or below 12 percent of all sea turtle interactions (i.e., maintain an 88% TED effectiveness rate). NMFS believes maintenance of this level of compliance will be achievable based on its analysis of recent documented compliance levels achieved in the Gulf.

5.1.3.3 Recent Efforts to Update Otter Trawl Bycatch Estimates Based on New Information

In light of the new information presented above, we attempted to update our bycatch estimates based on: (1) declines in the amount of shrimp fishing in the Southeast, (2) increases in the population sizes of Kemp's ridley and green sea turtles, and (3) information on shrimp industry compliance with TED regulations. Below we describe in detail the methodology we used in efforts to update our 2002 sea turtle interaction, capture, and mortality estimates and the results to project the future effects of otter trawls on sea turtles.

Shrimp Otter Trawl Effort

The SEFSC provided updated otter trawl effort data for 1998-2009 stratified by geographic subregion, depth stratum, and season according to Epperly et al. (2002). Epperly et al. (2002) described in detail how Gulf effort (hours fished) and Atlantic effort (days fished) were calculated based on available data, along with associated sources of error. The SEFSC followed the same methodology except for the details of the estimation of Atlantic effort as documented in Appendix 5. Maps of the statistical zones are available at http://www.sefsc.noaa.gov/images/stssn_statzone_gulf.gif and http://www.sefsc.noaa.gov/images/stssn_statzone_south.gif). Since effort is projected to remain at recent levels, 2009 effort data was used to represent anticipated future effort levels (Table 18 and 19)

Table 18. Estimated 2009 Shrimp Otter Trawl Effort (24-hour days fished) by Season, Depth Zone, and Gulf of Mexico Subegion

Season	Depth Zone	Subregion	
		Western Gulf (zones 13-21)	Eastern Gulf (zones 1-12)
Summer (March through November)	Inshore (inside COLREGS lines: bays and sounds)	16994	10199
	Nearshore (0-10 fm)	28068	5821
	Offshore (>10 fm)	22098	7681
Winter (December through March)	Inshore	2857	1945
	Nearshore (0-10 fm)	4444	1402
	Offshore (>10 fm)	4371	2623

Table 19. Estimated Shrimp Otter Trawl Effort (days fished) By Season, Depth Stratum, and South Atlantic Subregion

Season	Depth Zone	Subregion		
		South (zones 24-30)	Central (zones 31-33)	North (zones 34-36)
Summer (March through November)	Inshore	590	3,447	6,843
	Ocean	4,253	6,762	1,823
Winter (December through March)	Inshore	152	383	34
	Ocean[1]	1,435	948	164

[1] In the Atlantic, virtually all shrimp effort occurs within 10 fm, thus there is no offshore stratum for the Atlantic subregions.

Estimated Catch Rates of Sea Turtles in Shrimp Otter Trawl Nets

In a January 5, 2011, memorandum, the SEFSC informed SERO that there are no new data comparable to Epperly et al. (2002) available from which to estimate catch rates of sea turtles in shrimp trawls. The SEFSC indicated that using catch rate and aerial survey data that have not been updated in a decade was inappropriate because of expected sea turtle population changes over the last decade. The SEFSC advised that efforts should be made to update the information or develop alternative survey methods to estimate bycatch.

Of the five sea turtles, Kemp's ridley sea turtles have experienced the most significant increase. The most recent Kemp's ridley sea turtle assessment indicates the population has been increasing at a rapid rate. If population growth and recruitment maintain their current rates of increase, scientists estimate that by 2024, Kemp's ridley sea turtles may meet an important delisting criterion of 40,000 nesting females per season over a 6-year period. Green sea turtle populations have also been experiencing significant population growth (Chaloupka et al. 2008). Population size changes in the other species are less certain and not remarkable.

To account for changes in abundance of Kemp's ridley and green sea turtles between 1998 and 2009, we updated the unadjusted CPUE estimates we used for those species in the 2002 opinion (see Section 5.1.3.1, Review of NMFS (2002) Bycatch Estimation Methods, for details on the source of those CPUEs**)** by assuming a one-to-one relationship between population increase and

CPUE. The green and Kemp's ridley CPUE values were increased by an annual population scalar to reflect the change in population size between 1998 and 2009 (i.e., old CPUE* [annual population increase]$^{11 \text{ years}}$). The year 2009 was used to match our most recent effort data year. For Kemp's ridley sea turtles, because the vast majority of nesting occurs on a small number of well monitored beaches in Mexico, the annual scalar equated to the ratio of nests in year X compared to 1998 (e.g., 2009 = 19,110/3,482= 5.4882). This ratio represents an annual increase of approximately 19% per year. For green sea turtles, because there are several source rookeries interacting with southeastern shrimp fisheries and not all of them are well monitored, we conservatively used the annual population growth for the Tortuguero rookery (the largest rookery and the rookery with the slowest rate of increase, 4.9%) presented in Chaloupka et al. (2008) compounded 11 times (to represent the time that has elapsed) (i.e. 1.049^{11}=1.7) as our population scalar. In addition to assuming a linear relationship between CPUE and abundance, this method assumes: (1) a stable age distribution (i.e., nesting population increase = benthic turtle rate of increase), (2) that turtles are distributed on shrimping grounds the same way that they were in 1998, and (3) that current trend and survival and productivity rates remain constant after 2009.

For loggerheads and leatherbacks, given changes in population abundance from 1998 levels species are less certain and unremarkable, we used the same CPUEs as in Epperly et al. (2002) without any population adjustment. There are no CPUE data for hawksbill. Given interactions with this species are believed to be very rare, the analyses presented herein exclude this species. In Tables 20 and 21, we present the CPUEs used in our analysis, as well as the old CPUES.

Table 20. Sea Turtle Catch Rates in Shrimp Trawl Nets in the Gulf of Mexico

Sub-region	Season	Shore	Logger-head CPUE[1]	Leather-back CPUE[1]	Green CPUEs		Kemp's Ridley CPUEs	
					Old[2]	New	Old[2]	New
Eastern Gulf	Mar-Nov.	Inshore	0.05740	0.00101	0.00260	0.00440	0.03710	0.20361
		Nearshore	0.05740	0.00101	0.00260	0.00440	0.03710	0.20361
		Offshore	0.01000	0.00112	0.00260	0.00440	0.00030	0.00165
Western Gulf	Mar-Nov.	Inshore	0.01240	0.00012	0.00260	0.00440	0.03710	0.20361
		Nearshore	0.01240	0.00012	0.00260	0.00440	0.03710	0.20361
		Offshore	0.00060	0.00019	0.00260	0.00440	0.00030	0.00165
Eastern Gulf	Dec-Feb	Inshore	0.05740	0.00101	0.00260	0.00440	0.03710	0.20361
		Nearshore	0.05740	0.00101	0.00260	0.00440	0.03710	0.20361
		Offshore	0.01000	0.00112	0.00260	0.00440	0.00030	0.00165
Western Gulf	Dec-Feb	Inshore	0.01240	0.00012	0.00260	0.00440	0.03710	0.20361
		Nearshore	0.01240	0.00012	0.00260	0.00440	0.03710	0.20361
		Offshore	0.00140	0.00019	0.00080	0.00135	0.00030	0.00165

[1] Source= Epperly et al. 2002 [2]Source= Jamir, 1999

Table 21. Sea Turtle Catch Rates in Shrimp Trawl Nets in the U.S. South Atlantic.

Sub-region	Season	Shore	Logger-head CPUEs[1]	Leather-back CPUEs[1]	Green CPUEs		Kemp's Ridley CPUEs	
					Old[2]	New	Old[2]	New
North (zones 34-36)	Mar-Nov.	Inshore	0.63245	0.01410	0.01410	0.02386	0.12680	0.69591
		Ocean	0.63245	0.01410	0.01410	0.02386	0.12680	0.69591
Central (zones 31-33)	Mar-Nov.	Inshore	1.39440	0.01410	0.01410	0.02386	0.12680	0.69591
		Ocean	1.39440	0.01410	0.01410	0.02386	0.12680	0.69591
South (zones 24-30)	Mar-Nov.	Inshore	1.78950	0.01410	0.07020	0.11881	1.01750	5.58427
		Ocean	1.78950	0.01410	0.07020	0.11881	1.01750	5.58427
North (zones 34-36)	Dec-Feb	Inshore	0.63245	0.01410	0.01410	0.02386	0.12680	0.69591
		Ocean	0.63245	0.01410	0.01410	0.02386	0.12680	0.69591
Central (zones 31-33)	Dec-Feb	Inshore	1.39440	0.01410	0.01410	0.02386	0.12680	0.69591
		Ocean	1.39440	0.01410	0.01410	0.02386	0.12680	0.69591
South (zones 24-30)	Dec-Feb	Inshore	1.78950	0.01410	0.07020	0.11881	1.01750	5.58427
		Ocean	1.78950	0.01410	0.07020	0.11881	1.01750	5.58427

Estimated Otter Trawl Interactions

The number of interactions with shrimp otter trawls was calculated for each species and stratum using the following equation and the CPUE and effort data described above and presented in Tables 18-21: Interactions=CPUE $_{\text{species, strata, time,}}$*effort $_{\text{strata, time.}}$ Because Gulf otter trawl CPUEs were per hour, Gulf effort days were converted to effort hours by multiplying by 24 before conducting this calculation. South Atlantic CPUEs and effort data were both per day so no conversion was necessary. The results are presented in Table 22.

Table 22. Estimated Otter Trawl Sea Turtle Interactions

Region	Loggerhead	Green	Leatherback	Kemp's ridley	All species combined
Atlantic	33,204	1,251	378	50,106	84,939
Gulf	45,201	11,140	1,015	351,977	409,333
Total	78,405	12,391	1,393	402,083	494,272

Estimated Captures and Mortalities

For each species, the number of captures was estimated based on expected levels of future overall compliance (i.e., compliance associated with an overall capture rate of 12 percent) by assuming a one-to-one relationship between expected vessel compliance and effort (e.g., if 85 percent of vessels were documented in compliance we would assume 85 percent of effort was from compliant vessels) and the overall extent of violations and effort (e.g., if 10 percent of noncompliant vessels boarded had violations in a particular category, we assumed 10 percent of noncompliant effort had violations in that category). Sea turtle mortalities for each species were then estimated by multiplying the number of captures in each stratum by the proportion of animals expected to drown, based on the mortality rate estimates in Epperly et al. (2002) and reproduced in Table 5.23. The results are presented in Table 24.

Table 23. Proportion of Animals Retained in Trawls that Likely Drown by Area Subregion, Depth and Season. Source: Epperly et al. (2002).

Area/Subregion	Depth Stratum	Season	
		Summer	Winter
Eastern GOM	Inshore	0.8899	0.9842
	Nearshore	0.8899	0.9842
	Offshore	0.9351	0.9885
Western GOM	Inshore	0.9146	0.9826
	Nearshore	0.9146	0.9826
	Offshore	0.9588	0.9978
Atlantic North	Inshore	0.7303	0.8537
	Ocean	0.7303	0.8537
Atlantic Central	Inshore	0.7303	0.8537
	Ocean	0.7303	0.8537
Atlantic South	Inshore	0.4055	0.9930
	Ocean	0.4055	0.9930

Table 24. Anticipated Otter Trawl Sea Turtle Captures and Mortalities

Sea Turtles	Loggerhead	Green	Leatherback	Kemp's ridley	All Species Combined
Captures					
Atlantic	3984	150	45	6013	10193
Gulf	5424	1337	122	42237	49120
All	9409	1487	167	48250	59313
Mortalities					
Atlantic	2691	94	32	3632	6448
Gulf	4965	1245	113	38834	45157
All	7656	1339	144	42466	51605

Analysis of Effects on Hawksbill Sea Turtles

Hawksbill sea turtles are probably the least abundant species of sea turtle and certainly have the most limited distribution in the southeast United States. However, where hawksbills co-occur with the shrimp fishery (primarily in southwest Florida and south Texas), there is the possibility of capture in trawls [e.g., see (Epperly et al. 1995b) with respect to observed hawksbill capture in trawls].

The SEFSC was unable to provide bycatch estimates for hawksbill sea turtles because of a lack of CPUE data for hawksbill sea turtles. Epperly et al. (2002) noted the absence of hawksbill CPUE estimates might be attributed to the fact that hawksbill sea turtles associate with coral reefs or live bottom because of their diet of sponges, which require hard bottom for substrate for attachment, whereas shrimp trawling typically occurs over soft or sandy bottom habitat or in some grass areas.

In the 2002 opinion, in the absence of trawl CPUE data for hawksbills, we analyzed stranding data. Specifically, we estimated future annual at-sea hawksbill mortalities in the Southeast by calculating the 1999-2001 average number of annual strandings (i.e., 32 hawksbills, based on the best available information at that time) and then extrapolating that number based on the assumption that strandings make up only 5 to 6 percent of total at-sea mortalities (TEWG 1998). We then used that estimate to represent the maximum number of annual hawksbill mortalities attributed to shrimp otter trawls annually, noting that actual hawksbill mortalities attributed to shrimp otter trawls were expected to be much lower for a number of different reasons. We also attempted to estimate total interactions by assuming that those at-sea mortalities were all attributed to trawls equipped with TEDs with a 97 percent effectiveness (meaning 3 percent of sea turtles will not escape). However, the estimated total hawksbill trawl interaction was between 17,767-21,333 (533/3 percent and 640/3 percent). Because with numbers of this magnitude, we would expect that hawksbill turtles would have been recorded during the GSAFF study or recorded much more often during NMFS observed otter trawl trips, we concluded the estimate of interactions were not credible.

With still no hawksbill CPUE data, we believe strandings remain the best data source on which to estimate interactions. However, for this opinion we tried to make our estimate somewhat more realistic by analyzing only those stranding records that we believed could possibly be attributed to shrimp trawling. Records that we considered unlikely to be shrimp trawling-related were excluded, including cold-stuns, incidental captures, post-hatchlings, strandings <20 cm straight length (i.e., sea turtles that would not yet have recruited to the neritic habitat and be expected to occur on fishing grounds), entanglements, emaciated/sick turtles, and those noted as having gooseneck barnacles (indicative of long-time floating animals). We considered also excluding all strandings with evidence of boat-related damage, but chose to include those records where it was unknown if the strike was pre- or post-mortem.

Table 25 shows the number of hawsbill sea turtle strandings in the Southeast from 1999-2008 that may be attributed to shrimp fisheries. Out of 424 hawksbill strandings over this ten-year period, 198 were estimated to possibly be attributed to shrimp fisheries. The majority of these 198 sea turtles stranded dead, but a small number of live strandings each year were brought to rehabitation centers (3 in 1999, 2 in 2000, 4 in 2001, 5 in 2002, 3 in 2003, 1 in 2004, 2 in 2005, 5 in 2006, 3 in 2007, and 4 in 2008). Annual strandings ranged from as few as 12 to as many as 33, and averaged 20 per year over the entire time period. Seventy percent of the records were from the Gulf of which 66 percent were in Florida and the rest in Texas. In the South Atlantic, the vast majority were in Florida, with only 6 records in other states (4 in NC, 2 in GA). There does not seem to be a trend in the level of annual strandings. Despite annual variation in the number of strandings, the average number of strandings over the past five years barely differed from the past 10-year average.

Table 25. 1999-2008 Hawksbill Sea Turtle Strandings in the Southeast that may be Attributed to Shrimp Fisheries

Year	Total	Gulf	FL Gulf	TX	S. Atl.	FL S. Atl.	NC	GA
1999	17	11	6	5	6	6	0	0
2000	12	10	6	4	2	2	0	0
2001	33	27	23	4	6	6	0	0
2002	19	13	7	6	6	6	0	0
2003	22	12	8	4	10	10	0	0
2004	15	11	7	4	4	4	0	0
2005	28	19	13	6	9	8	1	0
2006	20	13	11	2	7	6	1	0
2007	15	9	4	5	6	6	0	0
2008	17	12	6	6	5	4	0	1
Total	198	137	91	46	61	58	2	1
Average all years	19.8	13.7	9.1	4.6	6.1	5.8	0.2	0.1
Average 2004-2008	19.0	12.8	8.2	4.6	6.2	5.6	0.4	0.2

We anticipate the potential impact from shrimp fisheries on hawksbill sea turtles will generally remain as represented by the stranding levels presented above. Because of oceanic conditions (i.e., currents, waves, wind) and the dynamic nature of the marine environment, it is likely that stranding records actually represent only a small number of the total at-sea mortalities (Murphy and Hopkins-Murphy 1989; Epperly et al. 1996). Studies of at-sea mortalities indicate stranding data only represent between 5 percent and 28 percent of all mortalities occurring at sea (Murphy and Hopkins-Murphy 1989; Epperly et al. 1996; TEWG 1998; Hart et al. 2006).

All estimates of the proportion of total mortalities that strandings comprise are highly uncertain and none are based on mark-recapture studies of sea turtle bycatch in shrimp fisheries. The 5-percent expansion value stems from the TEWG (1998) in which the NRC (1990) pre-TED sea turtle mortality estimate of 5,500 to 55,000 sea turtles for the 1980s was used in conjunction with the range of strandings observed in the late 1980's (1,191 to 2,373) to estimate that strandings represented from 3.6 (1,991/55,000) to 43.1 percent (2,373/55,000) of the total mortality. Based on the TEWG (1998) most likely estimates of 33,000 to 44,000, they estimated the expansion factor to be 5 to 6 percent. The other estimates of at-sea mortality stem from mark-recapture experiments using model turtles or turtle carcasses.

Given that the majority of sea turtle strandings were dead and that the few that were not dead required rehabilitation, an estimate based on stranding data is most representative of the number of mortalities that occur and not non-lethal interactions. To address the potential under-representation of hawksbill mortalities associated with shrimp fisheries by strandings in this opinion, we chose to use 28 percent as our expansion factor, based on the maximum percentage of at-sea mortalities represented by strandings according to the available studies noted above. Therefore, our estimate of the total number of hawksbill sea turtle mortalities that may be attributed to shrimps fisheries is an average of 71 hawksbills per year or 339 (95/28%) hawksbills every 5 years. Although this methodology is certainly less conservative than using the minimum of 5 to 6 percent like we did in NMFS (2002) and have used for stranding analyses for many other fisheries, we believe it is appropriate in this particular case. Our rationale is that if hawksbill sea turtles were really interacting with `shrimp trawls such that they were being killed so frequently, we would expect hawksbill catches to have been detected via the NMFS Shrimp Observer Program or the Foundation study. Also, while we did attempt to limit the records included to those that could possibly be attributed to shrimp fisheries, it is likely that some of these records are still the result of other causes.

5.1.4 Extent of Effects on Sea Turtles From Skimmer Trawls, Pusher-head Trawls, and Wing Nets (Butterfly Nets)

NMFS (2002) discussed the effects of skimmer trawls, pusher-head, and wing (butterfly) trawls qualitatively, but made no attempt to quantify the number of interactions. None of these gears were expected to result in significant mortalities. However, NMFS (2002) acknowledged that the use of skimmer trawls, in which tow times were limited by economic and not by practical reasons and whose use was becoming widespread in certain parts of the Southeast, should be carefully evaluated. NMFS (2002) cautioned that if NMFS finds, through research or observation, that the requirements of these exemptions are not being complied with or that exempted gear is being fished in a way that is harmful to turtles, then NMFS should amend the sea turtle conservation regulations to require the use of TEDs in that gear or during those activities.

Since that last consultation, skimmer trawls have become more widely used in inshore waters in the Gulf of Mexico and in North Carolina and are becoming even more popular. In the Gulf of Mexico, skimmer trawls now account for a large fraction of the shrimp fishing effort. Also, many skimmer trawl vessels have increased the size and amount of gear fished beyond what was originally established within the fishery, allowing them to fish in deeper water. In some cases, vessels are now rigged with both skimmer trawl frames and outriggers for use with conventional otter trawl nets.

The tail bag of a skimmer trawl fishes near the stern and allows for frequent haul-back while the rest of the rig is still fishing. Frequent dumping of the tail bag ensures better quality shrimp, with hopefully a better price to the fisherman, and is an economic incentive for tow time compliance. However, as a result of these larger skimmer trawl nets, there is a possibility that a sea turtle could be captured within the mouth of the net and not visible during a cursory codend inspection, a scenario that is compounded by the fact that many vessels fish at night. Due to these factors, coupled with the apparent increased abundance of sea turtles in the northern Gulf of Mexico, particularly Kemp's ridley sea turtles, the efficacy of turtle conservation requirements associated with skimmer trawl fisheries may have been less than previously thought. Butterfly nets, like skimmer trawls, are capable of incidental sea turtle capture. However, because the gear is fished off the bottom, in deeper parts of channels, the chance of turtle interaction with this gear may be somewhat less than skimmer gear. Butterfly nets can also have their tail bags hauled while the net continues to fish.

The alternative tow time restrictions specify tow times are not to exceed 55 minutes from April 1 through October 31, and 75 minutes from November 1 through March 31 (50 CFR 223.206(d)(3)(i)(A) and (B)). Some publications [e.g., (Price and Gearhart 2011)] cite Scott-Denton et al. (2006) as evidence of observations that tow times are often exceeded within the skimmer trawl fishery. Scott-Denton et al. (2006) evaluated catch characteristics of the Louisiana skimmer trawl fishery in 2004 and 2005, and they stated "tow time ranged from 0.2 to 4.3 h, with an average tow time of 1.7 h (+/- 0.4 s.d.)." Per the TED requirements at 223.206(d)(3)(i), the tow time for a skimmer trawl is measured "from the time the codend enters the water until it is removed from the water." Tow times in the study were recorded from the time the codend entered the water to the time the codend was retrieved to dump the catch, ending the tow. The times associated with lifting the codend for periodic checking for crab traps and possibly other debris were not recorded (E. Scott-Denton, NMFS, pers. comm.). Therefore, it is unclear to what extent the average tow times reported by Scott-Denton et al. (2006) might represent regulatory violations of the alternative tow time restrictions. These observations also raise the question of the sufficiency of the existing regulatory structure of the tow time definition in protecting sea turtles. If skimmer trawls can technically comply with the tow time limits without actually inspecting the entire net for potentially captured sea turtles, the conservation value of the alternative tow time restrictions may be reduced. Regardless, violations of tow times have been documented in 2010 and 2011, specifically one violation in 2010 and one in 2011 (R. Pittman, MDMR, pers. comm.). At this time, the extent tow time restrictions are exceeded by the skimmer trawl fleet in the Northern Gulf of Mexico and in North Carolina is unclear. Tow times restrictions are difficult to enforce. Documentation of a tow time violation requires enforcement personnel to be in close proximity of a skimmer trawl to monitor gear deployment and recovery, and to record the time when the codend enters the water until it is removed (50 CFR 223.206(d)(3)(i)). Also, enforcement personnel need to remain undetected for at least 55 minutes – practically an impossibility at sea – or else their presence may bias a vessel captain's operational procedure. Similarly, NMFS observers may also result in biased operational procedurals (i.e., the "observer effect"). Thus, it is likely that most tow time violations go undetected.

As part of this consultation, two attempts were made to estimate the number of sea turtle interactions, captures, and mortalities in skimmer trawls. We first produced draft estimates by applying the otter CPUE values as a proxy for skimmer trawl CPUEs to the "other trawl" (Gulf only) 2009 effort data stratified by geographic subregion, depth stratum, and season, according to Epperly et al. (2002). However, relying on otter trawl CPUE estimates, such as those used in Epperly et al. (2002), for the skimmer trawl fisheries was later deemed inappropriate due to potential gear selectivity issues between otter and skimmer trawls and a lack of observed effort in areas where skimmer trawl fisheries are primarily prosecuted; there was no observed otter trawl effort for inshore waters of the Western Gulf of Mexico and there was no observed otter trawl effort for any waters in the Eastern Gulf of Mexico (i.e., east of the Mississippi River) or North Carolina. We therefore only present the second approach we used, which bases skimmer trawl CPUEs on recent bycatch studies specific to skimmer trawls. The process for calculating sea turtle bycatch estimates for skimmer trawls is described below; estimates are provided separately for the North Carolina and Gulf of Mexico skimmer trawl fisheries. As noted previously, skimmer trawls are used in Louisiana, Mississippi, Alabama, Florida, and North Carolina. Because Florida already requires TEDs to be used by skimmer trawls in state waters, they were excluded from our analysis. Additionally, for the purposes of this analysis, butterfly/wingnet, and chopstick vessels are included in the bycatch estimates for Gulf of Mexico skimmer trawls. It should be noted that the generated estimates should not be considered explicit or definitive estimates of the number of animals actually captured, but rather a reflection on anticipated scale of effects.

North Carolina
In 2010, Price and Gearheart (2011) observed six North Carolina skimmer boats to examine target shrimp catch retention, bycatch reduction, and TED feasibility in the skimmer trawl fishery. During testing, a TED was installed in one net, while the other was left naked (i.e., no TED installed), with the TED switched between nets daily to remove potential vessel side bias. Fishing locations and times were considered to be representative of the North Carolina skimmer trawl fishery (B. Price, NMFS, pers. comm.).

Price and Gearheart (2011) observed 341 tows during 40 trips, for a total of 243 effort hours. No sea turtle interactions were observed in TED-equipped nets, but three Kemp's ridley sea turtles were captured in naked nets. To evaluate the status quo (i.e., no TEDs in skimmer trawls) the 243 hours of total effort was adjusted by 50 percent to reflect that observed effort was only for one naked net, versus two naked nets usually fished per vessel, resulting in 121.5 adjusted vessel effort hours. Therefore, CPUE for Kemp's ridley sea turtles based on observed take in Price and Gearheart (2011) was estimated to be 0.02469 turtles/hour (3 Kemp's ridley sea turtle captures / 121.5 effort hours = 0.02469).

Because Price and Gearheart (2011) only observed Kemp's ridley sea turtle captures, and in the absence of other appropriate data, a supplementary approach was developed to estimate take for remaining sea turtle species. CPUE values for other species likely to interact with the North Carolina skimmer trawl fishery were calculated by using inshore sea turtle stranding records for North Carolina as a reasonable representation of in-water species distribution. When reviewing strandings records for the past few years , several instances were noted where green sea turtle strandings exhibited significant spikes due to cold stunning events; green sea turtles are more prone to cold stunning events than other sea turtle species, and, therefore, could bias results. However, data from 2011 did not exhibit any anomalous cold-stunning stranding events. Using the relative abundance of sea turtle species documented in North Carolina inshore strandings records for 2011 (56, 52, and 72 Kemp's ridley, loggerhead, and green sea turtle strandings, respectively; [STSSN database]) resulted in relative abundance values of 31.11 percent for Kemp's ridley, 28.89 percent for loggerhead, and 40 percent for green sea turtles. These relative abundance values were then used to obtain CPUE values of 0.02293 and 0.03175 for loggerhead and green sea turtles, respectively (e.g., ([Kemp's ridley CPUE] 0.02469 / [Kemp's ridley relative abundance] 31.11)*([loggerhead relative abundance] 28.89) = ([loggerhead CPUE] 0.02293)), and can be seen below in Table 26. Based on the life history characteristics of leatherback sea turtles and the fact that leatherbacks do not appear in inshore strandings records for North Carolina leads us to believe they would be very rarely encountered, if at all, in the

North Carolina skimmer trawl fishery. Therefore, leatherback sea turtle interactions in skimmer trawls were discounted and excluded from further analysis. Hawksbill sea turtles were also excluded from this analysis because the strandings method we used for otter trawls incorporates all shrimp-related mortalities.

Table 26. CPUE Values and Relative Abundance of Sea Turtle Species for North Carolina.

Sea Turtle Species	CPUE Values Calculated From Price and Gearhart (2011)	Relative Abundance From STSSN (2001 NC Inshore Strandings)	Extrapolated CPUE Values
Kemp's Ridley	0.02469	31.11	-
Loggerhead	x	28.89	0.02293
Green	x	40.00	0.03175
Leatherback	x	0	0

In 2010, the North Carolina skimmer trawl fishery conducted 1,096 trips, which was up from 807 trips conducted in 2009 (S. McInerny, NCDMF, pers. comm.). Skimmer trawl trips are typically day trips, where the vessel departs and returns to the dock on the same day, which is reflective of the small average size of the vessels; approximately 55 percent of all 2010 trips were conducted by skimmer vessels less than 30 feet in overall length. The average effort per trip recorded by Price and Gearheart (2011) was 4.3 hours. Due to artifacts related to the study (e.g., documentation of catch composition), this is likely an under-estimate of average trip effort. Average trip effort was estimated to be 6 hours per trip, which takes into consideration transit time to and from the dock to the fishing grounds, as well as other fishery-related issues such as trip preparation, catch delivery, etc. As a result, total fishing effort for the North Carolina skimmer trawl fishery in 2010 was estimated to be 6,576 hours (1,096 trips x 6 hours = 6,576 hours). It should be noted that based on these estimates, Price and Gearheart (2011) observed approximately 3.6 percent of total trips and 1.85 percent of total estimated fishing effort conducted by the North Carolina skimmer trawl fishery in 2010, which is a considerably greater percentage of total effort than the observed fishing effort used to calculate CPUEs for the otter trawl fishery in Epperly et al. (2002), which was 0.05 percent for the Western Gulf of Mexico in 1997-1998.

Using the estimated CPUE for Kemp's ridley sea turtles and the total estimated effort hours, results in a total of 162 Kemp's ridley sea turtles captured by the North Carolina skimmer trawl fishery in 2010 (6,576 total effort hours x 0.02469 turtles/hour = 162.4 turtle takes). Likewise, we estimated 151 loggerhead and 209 green sea turtles captured in 2010. The resulting take estimates for the North Carolina skimmer trawl fishery are presented below in Table 27. Data on average skimmer trawl tow durations are limited. Mortalities were estimated for legal alternative tow times (55 minutes in summer, 75 minutes in winter) and for the average tow documented by Scott-Denton et al. (2006) of 1.7 hrs (102 minutes) (0.2 to 4.3 hours) (i.e., "long" tows) using the following model from Sasso and Epperly (2006):

- EXP (-4.6815+(0.0314*tow time))/(1+EXP(-4.6815+(0.0318*tow time)))
- EXP (-4.7967+(0.0469*tow time))/(1+EXP(-4.7967+(0.0469*tow time)))

Table 27. Estimated Captures and Mortalities of Sea Turtles by Species in the North Carolina Skimmer Trawl Fishery under Status Quo. (Estimated mortalities are based on compliance with alternative tow times or long [i.e., 102 minutes] tow times, which results in a 4.9 and 18.4 percent mortality rate, respectively.)

Sea Turtle Species	Estimated Captures	Estimated Mortalities: Legal Tow Times	Estimated Mortalities: Long Tow Times
Kemp's Ridley	162	8	30
Loggerhead	151	7	28
Green	209	10	38
TOTAL	**522**	**26**	**96**

Based on the estimated number of captures and effort hours, on average, a sea turtle is captured every 12.6 hours across the North Carolina skimmer trawl fleet. Furthermore, with only 64 total vessels in the North Carolina skimmer trawl fleet in 2010, on average, every skimmer trawl vessel captured 8.2 turtles during the course of the fishing year.

In order to project sea turtle captures and mortality estimates in a skimmer trawl fishery operating with installed TEDs as proposed, we needed to account for and consider the effect of anticipated TED violations on sea turtle capture rates and total mortalities. We did this by applying the same anticipated compliance level that we used for our otter trawl estimates to the skimmer trawl fishery, assuming TED compliance would be similar between the two fisheries. Last, we estimated the number of sea turtle mortalities by multiplying our estimated number of sea turtle captures in each stratum by the proportion of animals expected to drown, based on the mortality rate estimates in Epperly et al. (2002). Table 28 summarizes the anticipated number of sea turtle captures and mortalities across the North Carolina skimmer trawl fishery operating with required TEDs.

Table 28. Estimated Interactions, Captures and Mortalities of Sea Turtles by Species in the North Carolina skimmer Trawl Fishery Under Proposed TED Requirements. (Estimated mortalities are based on summary TED compliance and long [i.e., 102 minutes] tow times during the summer, which results 18.4 percent mortality rate.)

Sea Turtle Species	Estimated Interactions	Estimated Captures with TEDs	Estimated Mortalities with TEDs
Kemp's Ridley	162	18	4
Loggerhead	151	19	3
Green	209	25	5
TOTAL	**522**	**63**	**12**

Gulf of Mexico

There have been several skimmer trawl studies recently conducted in the Gulf of Mexico. Scott-Denton et al. (2006) observed 307 tows during 96 trips for a total of 517 effort hours in Louisiana coastal waters from September 2004 through June 2005; no sea turtle captures were documented. Likewise, Price and Gearheart (2011) observed a total of 156 tows for 69.99 adjusted effort hours (i.e., paired trawling with TED installed in one net) in Mississippi and Alabama coastal waters in 2008 and 2009 (J. Gearheart, NMFS, pers. comm.); again, no sea turtle captures were documented. In November 2011, skimmer trawl work, similar to the protocol used in Price and Gearheart (2011) was initiated in Louisiana coastal waters. The most recent study is still ongoing and results are preliminary, but out of the first 43 tows (approximately 19.3 adjusted effort hours) completed there was one recorded green sea turtle capture just south of Devil Island in Timbalier Bay (E. Scott-Denton, NMFS, pers. comm.). Therefore, CPUE for green sea turtles based on observed effort in Scott-Denton et al. (2006), Price and Gearheart (2011), and NMFS (unpublished data) was estimated to be 0.00165 turtles/hour (1 green sea turtle captures / 606.3 effort hours = 0.00165).

Similar to the approach used for the North Carolina skimmer trawl fishery, sea turtle strandings for the Northern Gulf of Mexico (i.e., Louisiana through Alabama) in 2010-2011 were used to determine relative abundances, that were, in turn, used to extrapolate CPUE values for other sea turtle species. The resulting values are presented in Table 29. As noted in the North Carolina analysis, leatherback sea turtles have not appeared in inshore strandings records for the Northern Gulf of Mexico and are unlikely to be encountered by skimmer trawls that operate in the shallow, inshore and nearshore waters of Louisiana, Mississippi, and Alabama; therefore, none are anticipated to be caught in skimmer trawls and they were excluded from further analysis.

Table 29. CPUE Values and Relative Abundance of Sea Turtle Species for the Northern Gulf of Mexico.

Sea Turtle Species	**CPUE Values Calculated From Scott-Denton et al (2006); Price and Gearheart (2011); and NMFS (Unpublished Data)**	**Relative Abundance From STSSN (2010-2011 LA , MS, AL Inshore Strandings)**	**Extrapolated CPUE Values**
Kemp's Ridley	x	92.5	0.04361
Loggerhead	x	3.5	0.00189
Green	0.00165	4.0	-
Leatherback	x	0	0

NMFS estimated total effort for Northern Gulf of Mexico skimmer trawl fisheries in 2009, was 24,399 effort days (i.e., 24-hour effort days), which equates to 585,576 effort hours (J. Nance, NMFS, pers. comm.). Using the estimated CPUE for green sea turtles and the total estimated effort hours, results in a total of 966 green sea turtles captured by the Northern Gulf of Mexico skimmer trawl fisheries in 2009 (585,576 total effort hours x 0.00165 turtles/hour = 966.2 turtle takes). Likewise, we estimated a total of 25,535 Kemp's ridley and 1,104 loggerhead sea turtles were captured in 2009. Mortalities were estimated for legal tow times (55 minutes in summer, 75 minutes in winter) and for the average tow documented by Scott-Denton et al. (2006) of 1.7 hrs average (0.2 to 4.3 hours) and using the following model from Sasso and Epperly (2006):

- EXP (-4.6815+(0.0314*tow time))/(1+EXP(-4.6815+(0.0318*tow time)))
- EXP (-4.7967+(0.0469*tow time))/(1+EXP(-4.7967+(0.0469*tow time)))

The resulting capture and mortality estimates for the Northern Gulf of Mexico skimmer trawl fishery are presented in Table 30. Estimated mortalities were calculated based on seasonal mortality rates for both legal tow times and long (i.e., 102 minutes) tow times from Scott-Denton et al. (2006) using the model discussed in Sasso and Epperly (2006).

Table 30. Estimated Captures and Mortalities of Sea Turtles by Species in Gulf of Mexico Skimmer Trawls Under Status Quo. (Estimated mortalities are based on [a] compliance with alternative tow times, which results in a 4.9 [summer] or 21.8 [winter] percent mortality rate, depending on season or [b] long [i.e., 102 minutes] tow times, which results in a 18.4 [summer] or 49.7 [winter] percent mortality rate, depending on season.)

Sea Turtle Species	Estimated Captures	Estimated Mortalities: Legal Tow Times	Estimated Mortalities: Long Tow Times
Kemp's Ridley	25,535	1,911	5,906
Loggerhead	1,104	83	255
Green	966	72	223
TOTAL	**27,606**	**2,065**	**6,385**

Based on the estimated number of captures and effort hours, on average, a sea turtle is captured every 21.3 hours across the Northern Gulf of Mexico skimmer trawl fleet. Furthermore, with an estimated 2,370 total active skimmer, butterfly/wingnet, and chopstick vessels (2008 data) in the Northern Gulf of Mexico fleet, on average, every vessel captured approximately 11.6 turtles during the course of the fishing year.

Based on anticipated compliance and associated TED effectiveness of 88 percent, and using the Sasso and Epperly (2006) methodology previously discussed, Table 31 summarizes the anticipated number of sea turtle interactions, captures and mortalities across the Northern Gulf of Mexico skimmer trawl fisheries operating with required TEDs.

Table 31. Estimated Captures and Mortalities of Sea Turtles By Species in Gulf of Mexico Skimmer Trawls Under Proposed TED Requirements. (Estimated mortalities are based on summary TED compliance and long [i.e., 102 minutes] tow times during the summer and winter, which results 18.4 and 49.7 percent mortality rates, respectively.)

Sea Turtle Species	Interactions	Estimated Captures with TEDs	Estimated Mortalities with TEDs
Kemp's Ridley	25,535	3,064	709
Loggerhead	1,104	133	31
Green	966	116	27
TOTAL	**27,606**	**3313**	**766**

North Carolina and the Gulf of Mexico Combined

The above analysis anticipates a total estimate of 6,482 total sea turtle mortalities annually in the combined skimmer trawl fisheries that currently operate without TEDs. Based on compliance results observed in otter trawl vessels operating in the South Atlantic and Gulf of Mexico shrimp fisheries, which have required TEDs for over two decades, the analysis anticipates a total estimate of 778 sea turtle mortalities annually should TEDs be required in the combined skimmer trawl fisheries. This represents a potential reduction of 5,704 sea turtle mortalities annually.

5.1.5 Extent of Effects on Sea Turtles from Activities Subject to Tow Time Restrictions in Lieu of TEDs

The proposed action would continue to allow a shrimp trawler to use tow times in lieu of TEDs if it: (1) is using a single test net (try net) with a headrope length of 12 ft or less and with a footrope length of 15 ft or less, if it is pulled immediately in front of another net or is not connected to another net in any way, if no more than one test net is used at a time, and if it is not towed as a primary net; (2) has on board no power or mechanical-advantage trawl retrieval system (i.e., any device used to haul any part of the net onboard; or (3) is a bait shrimper that retains all live shrimp on board with a circulating seawater system, if it does not possess more than 32 pounds of dead shrimp aboard, if it has a valid original state bait-shrimp license, and if the state license allows the licensed vessel to participate in the bait shrimp fishery exclusively. Other activities during which tow times in lieu of TEDs are allowed include: (1) the issuance of TED exemption letters for fishery research and to test new TED designs, (2) the issuance of TED exemptions for times and areas when the NOAA Assistant Administrator for Fisheries determines that environmental conditions (e.g., the presence of algae, seaweed, or debris) make TED use impracticable or that TEDs do not work in a particular area to protect sea turtles (see *Proposed Action* section for details), and (3) authorization letters issued by the Southeast Regional Administrator of NMFS to allow fishery research that would otherwise be subject to the TED requirements and to fishermen or researchers to develop modified or new TEDs, subject to any conditions and restrictions he deems appropriate (50 CFR 223.207(e)(2)). The alternative tow time restrictions specified at 50 CFR 223.206 (d)(2)(i) limit tow times to 55 minutes from April 1 through October 31, and 75 minutes from November 1 through March 31 and in some cases exemptions are conditioned to even shorter tow times.

Try Nets

"Try nets" are named such because they were invented to be used as a short tow to "try" an area before deploying the main trawls. Anecdotal information indicates try net use behavior is not consistent among fishermen trawling for shrimp. While some fishermen still tow try nets only before towing their main nets, others start towing try nets before deploying the main nets but then use them constantly. There are also some fishermen that tow try nets only intermittently as they are towing their main net.

Because try nets are not required to use TEDs, all sea turtle that interact with the gear are captured and may be observed via traditional observer programs. Since the NMFS Shrimp Observer Program became mandatory, 40 sea turtles have been observed captured in try nets. Unfortunately, while all sea turtles observed in try nets are recorded, observers monitor try nets tow times only intermittently (i.e., when not busy with duties related to the main trawl nets). Observers collect data on select individual try net tow characteristics, but they do not collect sufficient data on which to estimate the total amount of time try nets are used during a trip. Consequently, data on total observed try net effort or on a correlation between the observed try net effort relative to main net effort per trip are not available, so there is no way to generate a CPUE. Furthermore, even if it a CPUE could be generated, there is no fleet-wide try net effort for extrapolation.

Given the lack of actual try net effort data, we considered grossly estimating try net captures by assuming try nets and main nets have the same sea turtle CPUEs and effort as otter trawls. We concluded that differences in the number of nets towed (i.e., only one try net is towed per vessel whereas two to four main nets are towed at the same time) and the size of nets (i.e., try nets are much smaller than main nets) made such an assumption likely highly biased. Our conclusion is supported by Gulf and South Atlantic Fisheries Development Foundation (1998), which indicates try net sea turtle catch rates are considerably less than otter trawl catch rates. In the South Atlantic, only 2.4 percent (n=7) of all sea turtles caught (n=293) were caught in try nets. In the Gulf, 6.66 percent (n=2) of all sea turtles caught (n=30) were caught in try nets. Pooling the data from both regions, try net capture is only 2.5 percent of all captures. Therefore, to estimate try net captures, we applied the try net to otter trawl catch ratio (i.e., try net interactions=2.5 percent of otter trawl interactions) from Gulf and South Atlantic Fisheries Development Foundation (1998) to our Gulf and South Atlantic otter trawl interaction results (see Table 32).

Table 32. Sea Turtle Interactions Estimates for Try Nets

Sea Turtles	Loggerhead	Green	Leatherback	Kemp's ridley	All Species Combined
Atlantic	830	31	9	1253	2123
Gulf	1130	279	25	8799	10233
Total	1,960	310	34	10,052	12,356

Of the 40 sea turtles observed in try nets in the mandatory NMFS Shrimp Observer Program, all were reported as released alive and only one was noted as having injuries when released. This supports our previous assumption in NMFS (2002) that the small size and associated short tow times prevent these interactions from being lethal. Based on their manner of fishing and their relatively low effort and in the absence of any new information to suggest otherwise, we believe sea turtles caught in try nets are released alive and ultimately survive the encounter. We do not believe the use of tow times in lieu of TEDs in the above referenced gear adds to the total lethal capture of sea turtles associated with shrimp fisheries and overall impacts under the status quo regulations will be inconsequential.

Other Exempted Gears and Exempted Activities

Tow times can be an effective means of minimizing sea turtle mortality when fishermen comply with them. NMFS has always tried to restrict the tow time authorizations as much as possible to circumstances where tow times will naturally have to be limited out of physical or practical necessity. For example, recreational shrimpers who retrieve their nets by hand must keep their tow times short so the tail bag does not become so full as to not be able to pull in the net manually. As another example, bait shrimpers are also expected to have short tow times because they are expected to pull their nets in more frequently in order to keep the shrimp alive for use as bait.

Gears under the proposed action which are exempted from TEDs and subject to alternative tow times that target bait shrimp include beam and roller-frame trawls and hand gears to a much lesser extent. Epperly et al. (2002) describes both of the gears and their limited use, as well as their potential effects on sea turtles. A beam trawl is described as a shrimp trawl net which is attached at the mouth to a rigid pole, beam, or frame to maintain spread. Only Texas reports using beam trawls, and the gear is restricted in size to no more than 25-ft total width unless used as a try net, in which case it is limited to 5-ft in total width. Epperly et al. (2002) described beam trawl use as minimal and possibly limited to 15 vessels operating in Corpus Christi area: "The vessels were observed towing the gear dead astern, in shallow water, so that the floats and the top of the frame were exposed at the surface." Roller frame trawls are reported only in Florida, where they are used in seagrass and hard bottom habitats from St. Marks County to Pinellas County. The roller frame consists of a net attached to a rectangular metal frame (generally between 10 and 16 ft) with a slotted roller along the entire lower portion of the frame. The gear is designed to reduce bottom damage by rolling over rather than dragging through substrate. Based on their continued limited used and the manner in which the gear is used, the amount of anticipated sea turtle interactions is minor and mortalities are not expected. It is unlikely that a sea turtle would become entrapped within a roller frame trawl due to the required deflector bars position across the trawl mouth. Slow moving sea turtles caught in the path of the gear may become impinged against the frame for a short period, be overrun by the gear, or both. Such interactions are expected to result in only minor non-lethal effects.

On average from 2009-2011, 14 permits for experimental TED testing and 4 permits for fishery research were issued. The exemption letters issued for fishery research allowed the use of trawls without a TED for an average of 30 days with average tow times of 30 minutes. There have been no reported sea turtle mortalities associated with these research projects. TED exemptions (requiring the use of tow times in lieu of TEDs) issued by the Assistant Administrator for NMFS because of environmental conditions have also not been shown to cause significant problems. Since 1997, NMFS has issued these exemptions in North Carolina, Mississippi, Alabama, Texas, and Louisiana with no observed increase in sea turtle strandings during the exempted time periods. Over the past six years, these exemptions have mainly been in the Gulf in response to debris associated with hurricane impacts

For authorizations to conduct fishery research without TEDs, these restrictions invariably include a requirement to limit tow times, often to less than the 55/75 minutes allowed for shrimpers. Reporting of any sea turtle mortality is required as a condition of these authorizations, and none has ever been reported. These research or gear testing TED exemptions represent a very small portion of shrimp trawl fishing effort, compared to the larger, shrimp harvest fishery that is the main subject of the sea turtle conservation regulations.

We expect that NMFS will continue to issue such occasional exemptions in the future, as circumstances warrant, and with the cooperation of the affected states, although we cannot predict the frequency with which they may occur. NMFS (2002) concluded the use of tow times in lieu of TEDs in the above situations would not add to the total lethal interactions of sea turtles associated with the shrimp fishery in a statistically significant way. It noted the above conclusions about exempted gear and activities not posing a significant threat to sea turtles were based on knowledge of the gear and activities and the supposed desired outcomes (i.e. bait shrimpers wanting live shrimp) and compliance with tow time restrictions. There have still been no studies or comprehensive observer work done on these gears or activities to determine their actual effects on sea turtles, but we still believe their effects are inconsequential.

5.1.6 Summary and Review of Interaction Capture, and Mortality Estimation Efforts

Producing bycatch estimates for fisheries as large and diverse as the Southeastern shrimp fisheries is very complex and includes a large number of data sources and variables associated with shrimp effort, turtle catch rates, turtle mortality rates, effectiveness of TEDs, and compliance with existing regulations. Some of the available datasets are incomplete or old and many assumptions had to be made to overcome associated data gaps.

Table 33 summarizes our estimates of the number of interactions, captures, and mortalities for otter trawls, skimmer trawls, and try nets, based on the best available information. These estimates are much higher than those estimated in NMFS (2002) and more recently by the SEFSC, even though shrimp fishing effort has substantially declined since 2001.

Table 33. Sea Turtle Interactions, Captures, and Mortalities For All Gear Types

	Gear Component	Loggerhead	Green	Leatherback	Kemp's ridley	All Species Combined
Interactions	Otter Trawl	78,405	12,391	1,393	402,083	494,272
	Skimmer Trawl	1,255	1,175	0	25,698	28,128
	Try Nets	1,960	310	34	10,052	12,356
	All Gears Combined	81,620	13,876	1,427	437,833	534,756
Captures	Otter Trawl	9409	1487	167	48,250	59,313
	Skimmer Trawl	202	202	0	3,646	4,050
	Try Nets	1,960	310	34	10,052	12,356
	All Gears Combined	11,571	1,999	201	61948	75,719
Mortalities	Otter Trawl	7,656	1,339	144	42,466	51,605
	Skimmer Trawl	45	43	0	841	929
	Try Nets	0	0	0	0	0
	All Gears Combined	7,701	1,382	144	43,307	52,534

Two major processes are largely responsible for the increase in otter trawl interactions, captures, and mortalities compared to previous estimates. These are the incorporation of population growth estimates for Kemp's ridley and green sea turtles and the incorporation of recent TED compliance data. The population growth rates of both species are indicated by increases in the number of nests, and it is assumed that the change in nest numbers reflects a proportional change in the population size and CPUE. The overall number of interactions, captures, and mortalities is also increased by our incorporation of skimmer trawl and try net estimates; previously these gear types had been analyzed only qualitatively.

Population models predict the Kemp's ridley population will grow at least 12-16 percent per year, (19 percent based on updated model in NMFS et al. (2011), assuming current survival rates within each life stage remain constant (Heppell et al. 2005). Green sea turtle populations have also grown significantly. Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Tortuguero, Costa Rica, population growing at 4.9 percent annually. This information was used to update our otter trawl CPUEs.

The assumption that CPUE and population growth rate are linearly related is of questionable validity, and small changes in this relationship could have large impacts on the catch and mortality estimates. Numerous studies in fisheries have demonstrated that catch rates and abundance are often not proportional (Hilborn and Walters 1992; Harley et al. 2001) and a number of factors have been reported to affect catchability (i.e., the constant that relates abundance to CPUE) (Paloheirno and Dickie 1964; Rothschild 1977; Walters 2003; Maunder et al. 2006). These factors include variable efficiency of effort, species targeting, non-random and overlapping sampling effort, and environmental factors. Most of these studies focused on the relationship between target species CPUEs and abundance and whether CPUE can be used as an indicator of abundance, not whether increased abundance results in increased CPUEs. For a bycatch species, it is possible that the relationship would be different. Still, there is no data to support the extent of such a relationship and to assume a linear relationship is highly speculative. For example, shrimpers could have a local effect on density, resulting in an early season high catch rate that drops rapidly because sea turtles are not instantaneously responding to maintain a uniform distribution in each strata.

Previous sea turtle estimates have assumed 100 percent compliance with TED regulations, while the updated estimates consider a range of lesser compliance rates, based on recent inspection and enforcement activities. Our compliance analysis assumes that OLE boardings were random and representative of the fleet, both in terms of the overall compliance rates and the extent of violations of documented. Only a subset of the vessel boardings had sufficient detail to use in estimating their impacts on captures rates. Also, boardings in the Gulf of Mexico ranged from Texas to Florida, but the data from the Atlantic stemmed from Georgia boardings only with the exception of inspections during December 2011, which were from all South Atlantic states. Based on our discussion with experienced GMT personnel and OLE agents, we do not believe there was targeting bias associated with the selection of vessels during at-sea TED inspections that would result in lower boarding compliance rates compared to compliance rates of non-boarded vessels. In fact, the known presence of OLE in the area could affect the observed local compliance and result in higher boarding compliance rates compared to compliance rates of non-boarded vessels. There is potential for non-compliant vessels to be forewarned of an inspection patrol, i.e., radio communications between fishers, but such bias cannot be quantified.

Capture probabilities were derived based on a combination of empirical data (i.e., TED testing observations during which juvenile loggerheads were exposed to various configurations of non-compliant TEDs and TED testing [diver-assisted] assessments of a leatherback model passing through non-compliant TED configurations) and expert opinion of SEFSC gear technicians. The precision of resulting estimated capture probabilities is unknown and in making conservative decisions, may have inflated our estimates. For example, TEDs were assumed to have the same capture probabilities regardless of whether they were top-opening or bottom-opening designs.

However, in practice, TED testing observations and limited testing data indicate that top-opening TEDs are probably more effective in excluding sea turtles than bottom opening TEDs

In reviewing our bycatch estimates we considered their reasonableness or validity by considering current information on Kemp's ridley nesting, population growth/dynamics, and the level of mortality that that this population could sustain, maintaining its current population growth trends. Further sensitivity analyses were performed to evaluate the level of uncertainty in Kemp's ridley otter trawl interaction estimates described in Section 5.1.3.2. Sensitivity analyses included estimating interactions, captures, and mortalities using lower and upper confidence limits for catch per unit effort (as adjusted for population growth) summarized in Table 9 of Epperly et al. (2002) and using capture rates associated with best and average TED compliance rates observed by law enforcement.

Results summarized in Table 34 indicate that estimates of interactions, captures, and mortalities are all highly uncertain. Although it is unreasonable to assume that compliance is 100 percent, results are included here for purposes of comparison. Results indicate that interaction estimates for 2009 ranged from 193,410 to 657,125. Similarly, capture estimates ranged from 5,802 to 120,834 depending on the level of compliance assumed and presuming there are no multiple recaptures. If two interactions per sea turtle capture are assumed, then the number of captures would be cut in half. Mortalities were estimated to range from 5,122 to 102,079 assuming no multiple recaptures. Sea turtles are known to interact with otter trawls multiple times; therefore, estimates above likely overestimate total captures and mortalities. The number of times a sea turtle may interact with an otter trawl is not well estimated and subject to a variety of factors which may increase or decrease capture probability (see Section 5.1.2 for further information).

Table 34. Results of sensitivity analyses of Kemp's ridley otter trawl interaction estimates.

Catch-per-unit-effort	Compliance Rate		2009 Est. Interactions	2009 Est. Captures	2009 Est. Mortalities
	Gulf of Mexico	South Atlantic			
Mean	100%	100%	402,083	12,063	10,617
	2011 Aug	2011 Aug (Gulf)	402,083	25,769	22,680
	2011 Gulf Avg.	2006-2011 SA Avg.	402,083	73,341	62,263
Lower Confidence Level	100%	100%	193,410	5,802	5,122
	2011 Aug	2011 Aug (Gulf)	193,410	12,395	10,942
	2011 Gulf Avg.	2006-2011 SA Avg.	193,410	34,997	29,859
Upper Confidence Level	100%	100%	657,125	19,714	17,300
	2011 Aug	2011 Aug (Gulf)	657,125	42,114	36,957
	2011 Gulf Avg.	2006-2011 SA Avg.	657,125	120,834	102,079

Population trends were obtained from the USFWS and NMFS (2011) Kemp's ridley population model. The current Kemp's ridley population model (NMFS et al. 2011) estimated the total benthic population in 2009 was 311,798 sea turtles, based on demographic information and fits to current nesting data. The weighted mean annual survival of the benthic Kemp's ridleys, based on the population model, was 84 percent or 16 percent mortality from both natural and anthropogenic sources. The Kemp's ridley population was estimated to grow from 72,696 sea turtles in 2001 to 311,798 sea turtles in 2009. The total number of sea turtles killed by all sources of mortality was estimated to increase from 11,421 to 48,946 sea turtles during this same time frame. Population estimates were compared to annual Kemp's ridley sea turtle otter trawl interactions as calculated in Section 5.1.3.2. Results of this comparison are summarized in Figure 5. Otter trawl mortalities under average compliance levels, mean CPUEs, and a no recapture assumption were also compared to total mortalities (all sources) estimated by USFWS and NMFS (2011) (Figure 6)

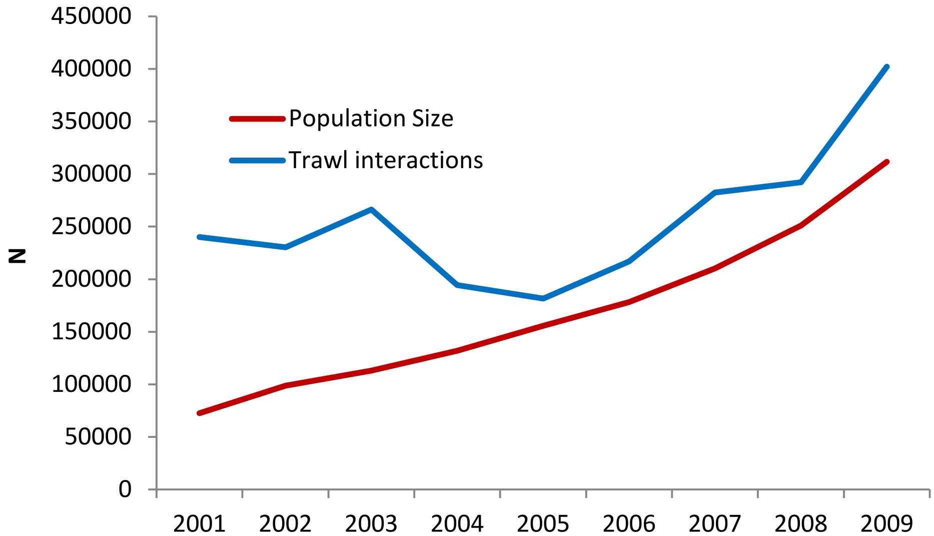

Figure 5. Comparison of Kemp's ridley population size estimates with otter trawl interaction estimates.

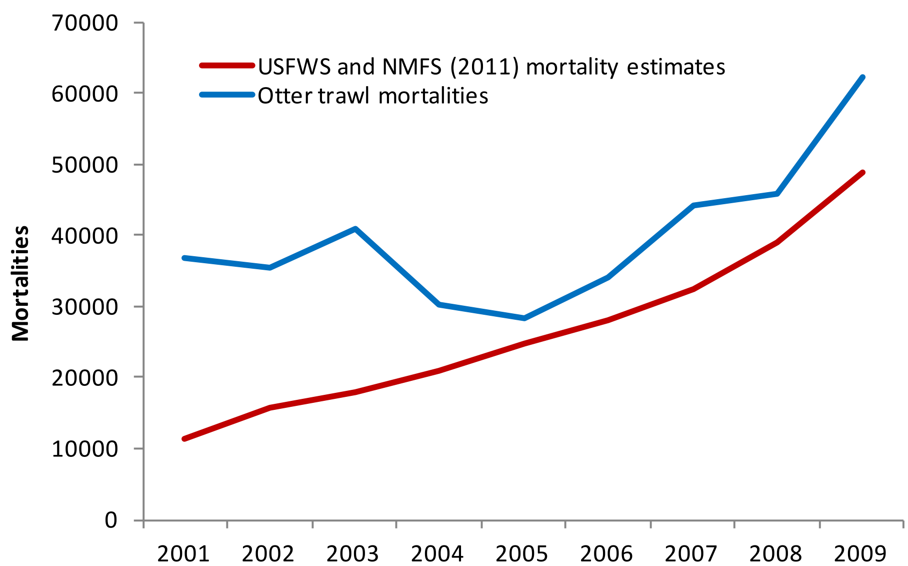

Figure 6. Gulf of Mexico and South Atlantic estimated Kemp's ridley otter trawl mortalities based on average CPUE and TED compliance rates, 2001-2009.

Our comparison reveals that trawl interactions exceeded population size estimates in all years, with otter trawl interactions in 2001-2003 exceeding population size estimates by 2.2-3.3 times (Figure 5). Similarly, otter trawl mortality estimates exceeded mortality estimates from the USFWS and NMFS Kemp's ridley population model (2011) in all years (Figure 6). Inclusion of skimmer trawl and try net interaction estimates would increase the number of interactions further, resulting in even higher ratios of interactions to population size. Additionally, the Kemp's ridley population model estimates mortality from both natural and fishing related sources, whereas estimates presented here only include a single gear segment of the U.S. shrimp fisheries. Inclusion of natural mortality and other fishing mortality related sources (e.g., Mexican shrimp fleet, recreational interactions, etc.) would further inflate our mortality estimates above those estimated by the population model. Although there is considerable uncertainty in both population size and trawl mortality estimates, estimates presented herein appear to be unreasonable and too high given that interactions and mortalities exceed annual population size and total mortality estimates.

We were not able to conduct similar comparisons for other sea turtle species because population models comparable to the Kemp's ridley model were lacking. However, many of the same assumptions as described above were made for other sea turtles, resulting in uncertain estimates in sea turtle interactions, captures, and mortalities. Also, all of these estimates relied on bycatch studies conducted in the late 1990s. These studies, which were used as the basis for the estimates generated in 2002 and which were then subject to many variables, assumptions, and biases to overcome data gaps, are now nearly fifteen years old. Based on review of our estimation efforts as detailed above, we believe there is too much unresolved uncertainty in our bycatch estimates to rely on them extensively in analyzing impacts, despite being based on the best available information. Our analyses do highlight though the dramatic relative impact that the extent of compliance with the TED regulations can have on sea turtle conservation.

5.1.7 Synthesis of Effects to Sea Turtles

While our bycatch estimates are much too uncertain to accurately predict a specific number of each sea turtle species adversely affected by the Southeastern shrimp fisheries, they can be used as a general and relative measure of the magnitude of the effects on each species. Concentrated in the shallow waters of the Gulf of Mexico and Atlantic coast where shrimp pressure is also concentrated, Kemp's ridley sea turtles remain the species most frequently captured and killed by offshore and nearshore shrimp trawl fisheries. The proposed action is anticipated to result in at least tens of thousands and possibly hundreds of thousands of Kemp's ridley sea turtle interactions annually. The proposed action is expected to substantially reduce mortality from those interactions, but thousands and possibly tens of thousands are still expected to be lethal annually. Loggerhead sea turtles are the second-most common interaction, with proposed action anticipated to result in at least thousands and possibly tens of thousands of loggerhead sea turtle interactions annually. The proposed action will reduce the number of lethal interactions, but at least hundreds and possibly thousands are still expected to be lethal. Green sea turtle interactions are anticipated to be substantially lower, but number at least in the hundreds and possible low thousands and mortalities may be in the hundreds. Leatherback sea turtle interactions are substantially less than green sea turtle interactions, within only a few hundred likely. Due to the offshore habits of leatherback sea turtles, these interactions are anticipated to occur in otter trawls but not skimmer trawls. Hawksbill sea turtles are the least affected sea turtle species by the proposed action, with interactions only in the tens of individuals or 100s, and mortalities in the tens. As noted earlier, direct evidence of hawksbill interactions is very sparse, and with little overlap likely between hawksbill habitat and skimmer trawl fisheries, it is likely that some, and possibly most of these records we are attributing to shrimping, are really attributable to other causes.

5.2 Effects on Smalltooth Sawfish

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

Direct effects of shrimp trawling in federal waters on the smalltooth sawfish are expected to result from physical interactions with fishing gear. The otter trawl is the only gear type used to harvest shrimp species in federal waters. Otter trawls are classified as active fishing gear because animals do not voluntarily enter the gear; they are either swept up from the seabed or netted from the water by the gear (NRC 2002). In this manner, smalltooth sawfish that are foraging within or moving through an active trawling location may be captured via entanglement in the trawl's netting and subsequently injured or killed.

The species' morphology causes it to be particularly vulnerable to entanglement in any type of netting gear, including the relatively small-mesh webbing used in shrimp trawls. The long toothed rostrum of the smalltooth sawfish penetrates easily through nets, causing the animal to become entangled when it attempts to escape.

Smalltooth sawfish were historically caught as bycatch in otter trawls (NMFS 2000). Early literature accounts document smalltooth sawfish as being frequently caught by shrimp trawls. For example, Bigelow and Schroeder (1953) p. 30, noted smalltooth sawfish were of "considerable concern to fishermen as nuisances because of the damage they do to drift- and turtle-nets, to seines, and to shrimp trawls in which they often become entangled; and because of the difficulty of disentangling them without being injured by their saws." Entangled smalltooth sawfish frequently had to be cut free, causing extensive damage to trawl nets and presenting a substantial hazard if brought on board. Most smalltooth sawfish caught by fishermen were either killed outright or released only after removal of their saw.

5.2.2 Potential Factors Affecting the Likelihood and Frequency of Smalltooth Sawfish Interactions with Trawl Gear

The spatial overlap between fishing effort and smalltooth sawfish abundance is the most noteworthy variable involved in anticipating interactions. The likelihood and frequency of sawfish trawl interactions are a function of the spatial and temporal overlap of the distribution of the species and fishing effort. The more abundant sawfish 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 sawfish will interact with gear. Environmental conditions may play a large part in both where sawfish are located in the action area and whether or not they interact with trawl gear. While trawling occurs throughout the Southeast, smalltooth sawfish are limited mainly to off the coast of Florida. The core range of the species is located in south and southwest Florida.

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 often 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) (NSED 2012).

Only 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. Also, because of the limitation of small juveniles to very shallow waters, they are unlikely to encounter trawls in the EEZ.

5.2.3 Estimating the Extent of Effects in Federal Fisheries

5.2.3.1 Estimating Total Interactions (Captures)

In NMFS (2005), we estimated one smalltooth sawfish would be caught in a shrimp trawl annually in the South Atlantic EEZ. Similarly in NMFS (2006), we estimated one smalltooth sawfish would be caught in a shrimp trawl annually in the Gulf of Mexico EEZ annually. These estimates were based on the fact that there had been only three reported sawfish interactions with shrimp trawls in the Gulf EEZ and three in the South Atlantic EEZ documented via all available sources (i.e. observer and anecdotal data) in the six years leading up to the consultation.

From 1992 through June 2007, carrying an observer in the Gulf EEZ was voluntary; coverage was typically less than 1% of total shrimp effort; and only one smalltooth sawfish was actually observed caught in a shrimp trawl. In July 2007, NMFS implemented a mandatory observer program component for the Gulf of Mexico federal shrimp fishery. Similarly, in 2008 a mandatory observer program was initiated for the South Atlantic federal shrimp fishery. Coverage levels in these fisheries are now about 2% of total effort. Seven additional smalltooth sawfish captures in shrimp trawl have been documented, all in waters off Florida in both the Atlantic and the Gulf.

Two recent attempts have been made to estimate incidental captures for smalltooth sawfish in the South Atlantic and Gulf of Mexico shrimp trawl fisheries using available observer data (NMFS-SEFSC 2010; NMFS-SEFSC 2011). The most recent report, NMFS-SEFSC (2011), encompasses incidental captures through 2010 and represents the best available data. All captures occurred in the main net of the otter trawl and no interactions with try nets have been reported.

Summary of NMFS SEFSC (2011) Data, Methods, Results and Discussion
From January 2002 through December 2010, 8 smalltooth sawfish have been observed in Gulf and South Atlantic trawls. Sawfish captured in non-sampled tows (n=2) or before the program became mandatory (n=1) were excluded from further analysis.

To reflect the species relatively limited distribution in the action area, data included in the analysis was limited to Statistical Zones 1-4 in the Gulf of Mexico and the South Atlantic portion of Statistical Grid 2 through Statistical Zones 24-26 in the US South Atlantic Ocean (Figure 1). While smalltooth sawfish have occurred above 26° latitude (Wiley and Simpfendorfer 2007; Wiley and Simpfendorfer 2010), reports from these northern areas are relatively rare, thus these periphery areas were excluded to provide a more realistic assessment of the current rate of bycatch. The catch data were analyzed with all combined (2008-2010).

Due to sparse observations temporally and spatially, a simple ratio estimator was used to represent bycatch estimates as: CPUE = number of sawfish/calculated towed hours fished. Incidental captures were estimated by the multiplication of CPUE from the archived observer database times the total number of trawl hours (NMFS-SEFSC 2011).

Observations from Gulf and South Atlantic shrimp trawls have documented five sawfish (3 in SAFMC waters and 2 in Gulf water) captured in 5,559 total tow hours. Bycatch rates varied depending on year and area. In the South Atlantic, CPUE was highest in 2009 and lowest in 2008 (CPUE=0.00). Total shrimp effort was higher in the Gulf of Mexico than in the South Atlantic. In the Gulf of Mexico, shrimp effort averaged 116,515 hours towed while in the South Atlantic shrimp effort was only estimated at 488 towed hours. Expanded annual incidental takes of smalltooth sawfish ranged from less than 1 animal to 96.33 animals depending on area and method used.
NMFS SEFSC (2011) points out the area where smalltooth sawfish were captured was extremely close (~40 nautical miles) to the Gulf of Mexico and South Atlantic Fishery Management Council's boundaries and splitting the capture in the analysis may bias estimates to one council or the other depending on the exact location of the take. It also notes shrimpers cover large areas during tows and it would not be unprecedented for vessels fishing in the southwest Florida area to begin their tow in one council area and end in the other. Given that the current range of smalltooth sawfish is largely restricted to the southwest Florida area and the nature of the shrimp fishery specific to this area, the incidental take estimate for all areas for smalltooth sawfish is likely more valid for the shrimp fishery overall.

NMFS SEFSC (2011) modeled the extrapolated incidental take of smalltooth sawfish using a three-year average of CPUE. As previously noted, the interaction between trawl gear and smalltooth sawfish is a rare event and is therefore inherently variable. Historically, as with other protected species, there have been very large inter-annual fluctuations in bycatch rates and estimates of total bycatch. Thus, any differences observed between short-term observations of bycatch of smalltooth sawfish and long-term averages may be simply stochastic events and are not necessarily indicative of a significant change in the interactions between fishing gear and the species. In an attempt to account for this fluctuation, NMFS SEFSC (2011) noted applying the 3-year average as opposed to a year estimate of CPUE is more valid when extrapolating to the total incidental take.

Incidental capture of smalltooth sawfish was determined using a 3-year average of CPUE for all areas combined (i.e. mean CPUE from 2008-2010 for all areas) multiplied by the total shrimp effort determined for all areas and effort calculated in statistical grids 1-4 (i.e. GMFMC) and the South Atlantic portion of Statistical Grid 2 through Statistical Zones 24-26 (i.e. SAFMC). Total effort for 2010 was not available for the South Atlantic and only preliminary results were available for the Gulf of Mexico, thus only the take of smalltooth sawfish for years 2008 and 2009, and 2008 and 2009 combined could be extrapolated (using the 3-year average).

The annual take estimates calculated based on combined effort across areas (Gulf and South Atlantic) and years (2008 and 2009) is 79.80 sawfish captures annually (NMFS-SEFSC 2011). We therefore estimate that the likely level of sawfish captures in federal fisheries is likely to be 240 over a three year period.

5.2.3.2 **Estimating Mortalities**

NMFS SEFSC (2011) did not estimate smalltooth sawfish mortality for the South Atlantic and Gulf of Mexico federal shrimp trawl fishery. NMFS estimated mortality for smalltooth sawfish in NMFS (2005; 2006), and in both cases anticipated all future smalltooth sawfish captures would be lethal. Available information at that time was scarce, but suggested that smalltooth sawfish previously captured in shrimp trawls did not survive the interaction. Although Simpfendorfer noted that the physical act of being captured by entanglement may not be lethal, mortality from air exposure was expected to occur quickly while hanging from the net out of the water (Simpfendorfer, pers. comm. 2005). The release condition of then-recent records of smalltooth sawfish caught in shrimp trawls had been known for only two interactions; in both cases, the smalltooth sawfish were caught in the netting prior to reaching the codend and left hanging in the net out of the water.

New observer information indicates that some smalltooth sawfish do survive trawl interactions. Of the five sawfish captured in shrimp trawls that were used in a more recent bycatch analysis (NMFS-SEFSC 2011), two were released alive, two animals were assumed to be discarded dead, and one released in an unknown condition. Of the total 8 observed captures, 2 were released dead, 4 were released alive and 2 with uncertain fates. Table 35 includes the detailed information from all observed encounters.

Table 35. Detailed Information on Observed Sawfish Interaction (Scott-Denton 2010)

Date	**Depth (ft)**	**Detailed Observer Notes on Condition and Fate**
6/7/2002	22	Caught net position 3; tore up net; released alive; swam away on surface
7/26/08*	157	Captured in portside net; tangled by saw in mesh right in front of the TED (according to crew); female ~15 ft, brought on deck (weak); released rolled on back and sank, not believed to have survived
3/5/2009	184	Sawfish blocking TED, ~12’ long, caught up in net, put back down hoping it would pop out; appeared to be dead; later cut out of net; most

		likely dead;
3/6/2009	185	Sawfish caught on trawl body on outside of net while previous sawfish still stuck in TED (see record); cut free from outside of net alive.
3/9/2009	183	Sawfish on net #3, tumbled out of net; released alive
12/23/2009	105	Sawfish bill was caught on TED and shook free by crew; ~12 ft in total length with~5 ft bill; fell out of port inside net; swam away live
2/19/2010	130	~6.5 long. The net was brought on board and the sawfish was cut out; when released it was fighting as descended; it may have turned belly up
2010*	44	Smalltooth sawfish with saw stuck at TED; 12’ total length; ~4’ saw; captain cut mesh around saw to release unharmed

*The sawfish captured on these dates were captured from a non-sampled tow and were restricted from analysis in NMFS-SEFSC 2011.

Sawfish caught incidentally as bycatch are subject to the cumulative physical and physiological rigors of capture, handling and deck-time (air exposure). However, there are no studies of the physiological consequences of capture stress in sawfish, and relatively few studies have investigated the physiological consequences of capture stress in elasmobranchs, or have sought to compare responses to given stressors by species. There are also no studies on post-release mortality of smalltooth sawfish released alive from trawls (or from any gear type).

The recovery plan (NMFS 2009) states that available data on interactions between trawl fisheries and the U.S. DPS of smalltooth sawfish are very limited, but that shrimp trawl fisheries are associated with high sawfish mortality per interaction. For now, the release condition of known captures provides the best insight into their ultimate fate. A review of the observer notes on each event document reveals that sawfish fate may be a function of the severity of the entanglement and the crew’s ability to free it from the net. Those sawfish that were lightly entangled and/or quickly returned to the water were in the best condition. Smalltooth sawfish are generally referred to by experienced field biologists as hardy, robust fish. Thus, smalltooth sawfish that appear in good health when released and that are observed swimming away likely only experience short-term - sublethal effects from non-trawl gear (rod and reel, bottom longlines, and seine nets).

Although none of the observed sawfish released alive were noted as injured, smalltooth sawfish may be released with some injuries. Seitz and Poulakis (2006) list chafing and irritation of the skin, as well as the loss of rostral teeth, as consequences of entanglement in marine debris; such conditions would result from trawl entanglement. They also reported damage from incidental capture in other types of fishing gear range from broken rostral teeth to broken rostrums. The loss of rostral teeth could be especially detrimental because, unlike other elasmobranchs, smalltooth sawfish do not replace lost teeth (Slaughter and Springer 1968). Since the smalltooth sawfish’s rostrum is its primary means for acquiring food, the loss of rostral teeth may impact an animal’s ability to forage and hunt effectively. 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, is likely to hinder their ability to feed and may have long-term impacts, including mortality.

Based on the condition information from the eight observed sawfish interactions (Scott-Denton 2010), we conservatively estimated three of them (i.e. the 7/26/08, 3/5/09, and 2/19/10 captures) resulted in mortality. Although the observer notes from the capture on February 19 did not state the individual would likely die, it noted it "may have gone belly up." This led us to be uncertain of its actual fate, thus we conservatively assumed it was lethal too. Therefore, the mortality rate for observed smalltooth sawfish captured in the federal shrimp fisheries is 37.5% (3÷8). Applying this mortality rate to the triennial 240 captures, we estimate 90 smalltooth sawfish will be killed in federal shrimp fisheries every three years.

5.2.4 Effects of the Sea Turtle Conservation Regulations

Based on the available information, the use of TEDs in the shrimp trawl fishery likely does not affect smalltooth sawfish interactions rates in federal or state water shrimp fisheries because smalltooth sawfish become entangled in the net as the nets narrow and before they can escape through a TED opening. In the event that an animal did remain free in the net long enough, it is conceivable that a smalltooh sawfish could free itself by swimming out ofthe TED. In any event, the TED would certainly not increase the likelihood of capture or the magnitude of impacts resulting from capture.

5.3 Effects on Atlantic Sturgeon

In Sections 5.3.1- 5.3.3, we consider the effects of NMFS' authorizing shrimp trawling in the South Atlantic EEZ on Atlantic sturgeon. In Section 5.3.4, we consider effects of NMFS' implementation of the sea turtle conservation regulations in the South Atlantic. NMFS' authorization of shrimp trawling in the Gulf of Mexico and its implementation of sea turtle conservation regulations in the Gulf of Mexico both have no effect on Atlantic sturgeon because the species' distribution within the action is restricted to the South Atlantic portion of the action area.

5.3.1 Types of Interactions (Stressors and Individual Response to Stressors)

Direct effects of NMFS - authorized shrimp trawling on Atlantic sturgeon are expected to result from physical interactions with otter trawl gear use in the South Atlantic federal shrimp fishery. The otter trawl is the only gear type used to harvest shrimp species in federal waters. Otter trawls are classified as active fishing gear because animals do not voluntarily enter the gear; they are either swept up from the seabed or netted from the water by the gear (NRC 2002). In this manner, Atlantic sturgeon that are foraging within or moving through an active trawling location may be captured via envelopment or entanglement in the trawl's netting and subsequently injured or killed. Atlantic sturgeon may also escape through TEDs unobserved. While this could greatly increase the survival of Atlantic sturgeon interacting with shrimp trawls, it could also result in stress or injury to individuals escaping through the TED.

5.3.2 Potential Factors Affecting the Likelihood and Frequency of Atlantic Sturgeon Interactions with Trawl Gear

The spatial overlap between fishing effort and Atlantic sturgeon abundance is the most noteworthy variable involved in anticipating interactions. The more abundant Atlantic sturgeon on South Atlantic fishing grounds are, and the more fishing effort, the greater the extent of interactions.

The ASMFC (2007) reported on Atlantic sturgeon bycatch in various types of fishing gear. They determined that there are no significant differences in bycatch in otter trawls based on the mesh size classes that were observed, although meshes in the range of 100-150 mm may be moderately more likely to be associated with Atlantic sturgeon bycatch. The ASMFC found the greatest correlation between Atlantic sturgeon bycatch and depth fished with otter trawls. The majority (84 percent) of Atlantic sturgeon bycatch in otter trawls occurred at depths less than 20 meters, and about 90 percent of bycatch was observed at depths less than 30 meters.

Because different life stages of Atlantic sturgeon are associated with different habitat types and water depths, the likelihood and frequency of Atlantic sturgeon interactions varies by life stage. Only trawl interactions with adult and subadult Atlantic sturgeon are expected because younger life stages do not enter the marine environment. Adult Atlantic sturgeon will reside in the marine habitat during the non-spawning season and forage extensively. Coastal migrations by adult Atlantic sturgeon are extensive and are known to occur over sand and gravel substrate (Greene et al. 2009). Atlantic sturgeon remain in the marine habitat until the waters begin to warm, at which time ripening adults migrate back to their natal rivers to spawn. Sub-adult Atlantic sturgeon also utilize the marine environment for foraging and for migration between estuaries and bays. Trawl surveys conducted off Virginia and North Carolina between 1988 and 2006 as part of the Cooperative Winter Tagging Cruises captured primarily subadult Atlantic sturgeon (141 subadults out of 146 total Atlantic sturgeon captures) (Laney et al. 2007). Laney et al. (2007) reported that this could either be due to the age structure of the Atlantic sturgeon population or to gear selectivity, with adult Atlantic sturgeon better able to swim away and escape capture.

5.3.3 Estimating the Extent of Effects

5.3.3.1 Estimating Total Interactions and Captures

NMFS has received reports from the mandatory federal observer program of nine Atlantic sturgeon captures in the South Atlantic shrimp trawl fisheries. All captures occurred within state waters (Figure 7). Seven Atlantic sturgeon were captured by a single shrimp trawler off Winyah Bay, South Carolina, from October 27-29, 2008 (E. Scott-Denton, NOAA, pers. comm.) Six were caught in the main otter trawl gear and one was captured in the try net. The sturgeon were caught in 18-30 feet of water. All were approximately 900 to 1,000 mm total length. Six of the incidentally caught Atlantic sturgeon were released alive, one was released dead. One Atlantic sturgeon was captured by a shrimp trawler off South Carolina near Kiawah Island, South Carolina, on December 13, 2011 (E. Scott-Denton, NOAA, pers. comm.), and was released alive. Two Atlantic sturgeon were captured by a shrimp trawler near Sapelo Island, Georgia, from December 27-29, 2011 (E. Scott-Denton, NOAA, pers. comm.) Both were approximately 2 feet long and both were released alive.

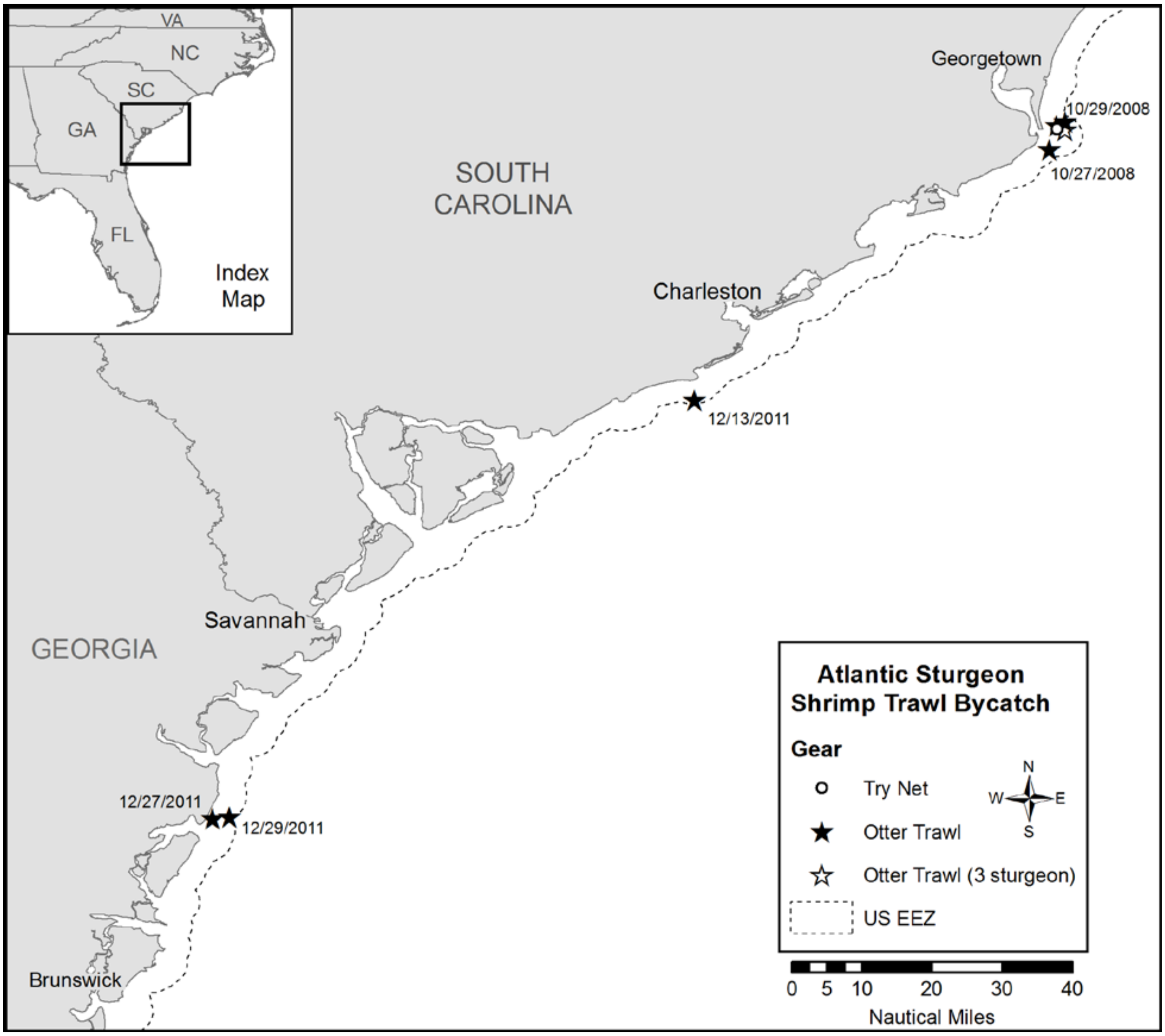

Figure 7. Locations and dates of captures in state waters of nine Atlantic sturgeon by three shrimp trawlers in the South Atlantic based on observer reports.

The federal fishery observer program became mandatory in the South Atlantic federal shrimp fishery in 2008. The new mandatory program made observer data more random and unbiased, and better suited for use in fishery statistics. For 2008 to 2011, the total number of days at sea South Atlantic fisheries were observed was 650 days (E. Scott-Denton, NOAA, pers. comm.). From 2008 to 2011, nine Atlantic sturgeon were captured in otter trawl gear by South Atlantic shrimp trawlers during the 650 days at sea observed for a bycatch rate of nine sturgeon/650 days or 0.014 Atlantic sturgeon per day. The latest available data on fishing effort in the combined state and federal South Atlantic shrimp fisheries are from 2009, when effort was 13,464 days at sea for the year. Multiplying the fishing effort by the bycatch rate (13,464 days x 0.014 sturgeon per day), we estimate that approximately 189 Atlantic sturgeon were captured in otter trawl gear by shrimp trawls in 2009. All of the reported captures of Atlantic sturgeon in the South Atlantic shrimp trawls occurred in state waters; however, it is not uncommon for fishers to trawl between state and federal waters. The majority (about 61 percent) of observed shrimping in the South

Atlantic occurred in state waters, and this is representative of the entire South Atlantic shrimp fleet (E. Scott-Denton, NOAA, pers. comm.). It seems likely that the catch rates of sturgeon are higher in state waters than federal waters, based on their apparent preference for coastal, shallower waters, the observed catches- nine in state waters versus zero in federal waters, while sampling was distributed roughly 60:40- further supports this likely differential. We do, however, know that Atlantic sturgeon are caught by other trawl fisheries in the EEZ, and we believe that the federal shrimp fishery catches them too. Therefore, using a combined state-federal CPUE is reasonable and conservative. Therefore, we estimate that about 39 percent of the 189 estimated captures of Atlantic sturgeon by otter trawl gear or 74 estimated captures of Atlantic sturgeon by South Atlantic shrimp fisheries in otter trawl gear may have occurred in federal waters.

The total number of sturgeon that interact with otter trawl gear in the shrimp trawls is likely much higher than simply the number of Atlantic sturgeon observed captured in shrimp trawl nets. Anecdotal reports and scientific research indicate that Atlantic sturgeon escape through TEDs installed in trawls. Flexible Flatbar Flynet TED testing was conducted in North Carolina from 2008 through 2009 by the NMFS SEFSC Pascagoula Laboratory to evaluate catch loss aboard contracted commercial vessels utilizing the trouser trawl technique (NMFS-SEFSC 2012). A standard 85-foot flynet trawl was modified to accommodate two separate codends with a divider panel originating at the codend split and extending into the body of the trawl. This technique was chosen because of the high between-tow catch variability associated with flynet trawls. The TED was installed in one codend, while no TED was installed in the other net to serve as a control. Atlantic sturgeon were incidentally encountered during testing. Video obtained from a camera mounted behind the TED opening revealed several sturgeon escaping through the TED opening. In the course of four tows, the control net (with no TED) captured a total of 15 sturgeon, while the net with the TED captured only two Atlantic sturgeon. Based on this data, the TED resulted in an 87 percent reduction in Atlantic sturgeon bycatch by number of individuals (i.e., two Atlantic sturgeon were captured and 13 are assumed to have escaped capture through the TED out of an estimated 15 Atlantic sturgeon encountering the trawl gear). There was a 95 percent reduction by weight (i.e., 6 kgs of Atlantic sturgeon were captured in the net with the TED versus 109.1 kgs of Atlantic sturgeon in the control net), suggesting that sturgeon that do not exit the net through the TED are smaller individuals. We applied this information to the estimated 2009 incidental captures of Atlantic sturgeon by otter trawl gear in federal waters. Our estimated capture of 74 Atlantic sturgeon by otter trawl gear in federal waters was likely only 13 percent of the total number of Atlantic sturgeon interacting with the federal fishery. We estimate that a total of 570 Atlantic sturgeon (i.e., 74 captured/13 percent of the total interactions) interacted with the South Atlantic federal shrimp fishery based on the 2009 effort data, with 13 percent (74 Atlantic sturgeon) incidentally captured in shrimp nets and 87 percent (496 Atlantic sturgeon) escaping through TEDs unobserved.

In analyzing the effects of the proposed action on sea turtles, we discussed how the extent of non-compliance can affect release sea turtle release rates. TED violations may also lower the ability of Atlantic sturgeon to escape capture via TEDs, but we did not attempt to account for impacts of lowered compliance on Atlantic sturgeon capture/interaction rates. Available information indicates sturgeon caught sometimes go through the TED and are captured in the main net, or can be captured before the TED. All of the sturgeon captured during the flexible flatbar flynet TED testing were documented as caught passed through the bars of the TED and into the codend. These fish were captured due to their smaller size and their ability to pass through the bars, not because of problems navigating the TED. Given obvious differences between sea turtles and sturgeon (i.e. morphology and size, behavior), we would expect the impact of violations to be different and for sturgeon to less impacted by at least certain violations (e.g. their narrow body size would likely allow them to navigate smaller openings than required etc.), but we have no data to support quantifying an effect on sturgeon. Because our analysis makes other very conservative assumptions regarding catch rates in federal waters, mortality rates, and DPS assignment, we believe it encompasses any adverse impacts of TED violations and is sufficiently risk-averse.

Atlantic sturgeon can also be captured in try net gear used in shrimp fisheries. From 2008 to 2011, one Atlantic sturgeon was captured in a try net by a South Atlantic shrimp trawler during the 650 days at sea observed for a bycatch rate of one sturgeon/650 days or 0.0015 Atlantic sturgeon per day. The latest available data on fishing effort in the South Atlantic shrimp fisheries is from 2009, when effort was 13,464 days at sea for the year. We estimate that approximately 21 Atlantic sturgeon (0.0015 Atlantic sturgeon per day x 13,464 days) were captured in try nets by South Atlantic shrimp fisheries in 2009. The only recorded capture of an Atlantic sturgeon in a try net occurred in state waters. However, based on known fishing effort in federal versus state waters, about 39 percent of the 21 estimated captures or nine of the estimated captures of Atlantic sturgeon by try nets used in the South Atlantic shrimp fisheries occurred in federal waters.

5.3.3.2 Estimating Mortalities

Studies in a variety of fisheries have shown that mortality of Atlantic sturgeon incidentally caught in trawl gear is very low, with most surveys showing zero percent mortality (e.g., Stein et al 2004). Based on observer data from South Atlantic shrimp fisheries, one mortality was observed out of the nine Atlantic sturgeon that were incidentally captured in otter trawl gear between 2008 and 2011 (E. Scott-Denton, NOAA, pers. comm.), for a mortality rate of 1/9 or 11 percent. This is high compared to most reports for trawl fisheries. It may be an artifact of the low number of observed incidental captures of Atlantic sturgeon in shrimp trawl fisheries, or it may reflect some difference between shrimp trawling and other trawl fisheries, perhaps an effect of warmer, southern waters. In any event, using this apparently high mortality rate will be a conservative approach. Applying the estimated mortality rate to the estimated 2009 incidental captures of Atlantic sturgeon in federal waters, we estimate that 11 percent of the 74 Atlantic sturgeon, or nine Atlantic sturgeon, incidentally captured in federal waters would die after their capture. There was no observed mortality for sturgeon captured in try nets, most likely due to the fact that try nets are used for short tows to determine the fish ability of an area. Based on the short tow times and lack of observed mortality, we do not believe Atlantic sturgeon will be killed in try nets.

5.3.3.3 Assigning Interactions to the Five Atlantic Sturgeon DPSs

Atlantic sturgeon mix extensively in the marine environment, and individuals from all five Atlantic sturgeon DPSs could interact with the federal shrimp trawl fishery in the South Atlantic.

The NMFS Northeast Region did a Mixed Stock Analysis (MSA), an analysis of the composition of Atlantic sturgeon stocks along the East Coast, using tag-recapture data and genetic samples that identify captured fish back to their DPS of origin. Atlantic sturgeon can be assigned to their DPS based on genetic analyses with 92-96 percent accuracy (ASSRT and NMFS 2007), though some fish used in the MSA could not be assigned to a DPS. Data from the Northeast Fisheries Observer Program and the At Sea Monitoring programs were used in the MSA to determine the percentage of fish from each of the DPSs at the selected locations along the coast.

The raw results of the genetic analyses were examined to determine if natural geographic boundaries emerged where DPS composition made significant shifts. Given the relatively small number of samples, boundaries were not obvious from the genetics data alone. In looking at the coastal samples, there appeared to be three zones that coincided with biogeographic zones. These biogeographic zones or marine ecoregions were defined by The Nature Conservancy (TNC) and refined in 2007. Marine ecoregions are zones in which the species composition is relatively homogenous and is clearly distinct from adjacent systems. The dominant biogeographic features used to define the ecoregions included features such as isolation, upwelling, nutrient inputs, freshwater influx, temperature regimes, ice regimes, exposure, sediments, currents, and bathymetric or coastal complexity. Along the East Coast of the U.S., there are three marine ecoregions. Based on TNC ecoregions, the Carolinian marine ecoregion, which extends from Cape Hatteras to the tip of Florida, corresponds to the South Atlantic portion of the action area where the shrimp fishery operates. According to the MSA, the composition of Atlantic sturgeon in this ecoregion by DPS is:

- 0-9% Gulf of Maine DPS
- 4-26% New York Bight DPS
- 7-18% Chesapeake Bay DPS
- 10-29% Carolina DPS
- 46-79% South Atlantic DPS

To be conservative, we will assume that the maximum percentage presented for each DPS is representative of the composition of Atlantic sturgeon in the South Atlantic. Table 36 contains estimates of numbers of Atlantic sturgeon interactions with otter trawl gear in the South Atlantic shrimp fisheries in federal waters by DPS based on 2009 effort data. The total numbers of interactions of each Atlantic sturgeon DPS with otter trawl gear were estimated by multiplying the maximum percentage of each DPS comprising the Atlantic sturgeon stock in marine waters in the South Atlantic by the total number of estimated interactions of Atlantic sturgeon with otter trawl gear (570 total interactions; section 5.3.3.1). The total numbers of Atlantic sturgeon from of each DPS potentially captured in otter trawl gear were estimated by multiplying the same maximum percentages of each DPS expected to be present in the South Atlantic by the total number of estimated Atlantic sturgeon captures (74 total captures; section 5.3.3.1). The numbers of Atlantic sturgeon from each DPS evading capture by passing through TEDs installed in shrimp trawls were estimated by subtracting the estimated numbers of Atlantic sturgeon captured from the estimated number of total interactions for each DPS. The number of captures from each DPS was calculated first to err on the side of caution with regards to the more adverse effect of being captured versus escaping through the TED. Total mortality for each DPS was estimated by multiplying the total captures from each DPS by the 11 percent mortality rate calculated in section 5.3.3.2. Note that the percentages will add up to more than 100 percent and the total of each category of interactions by DPS will be greater than the number of interactions presented in the previous section due to the usage of the highest percentage calculated by the MSA for each DPS.

Table 36. Estimated number of Atlantic sturgeon interactions with otter trawl gear in the South Atlantic shrimp fishery in federal waters by DPS based on 2009 effort data. GOM = Gulf of Maine DPS, NYB = New York Bight DPS, CB = Chesapeake Bay DPS, and SA = South Atlantic DPS.

DPS	Maximum Estimated Representation in the South Atlantic	Total Estimated Interactions with Otter Trawl Gear in the South Atlantic Shrimp Fishery	Total Estimated Atlantic Sturgeon Escaping Through TEDs	Total Estimated Captures of Atlantic Sturgeon in Otter Trawl Gear	Total Estimated Mortalities of Atlantic Sturgeon Interacting with Otter Trawl Gear
GOM	9%	51	44	7	1
NYB	26%	147	128	19	3
CB	18%	102	88	14	2
Carolina	29%	163	141	22	3
SA	79%	444	386	58	8

We also estimated the numbers of Atlantic sturgeon interactions with try nets in the South Atlantic shrimp fishery in federal waters by DPS based on 2009 effort data (Table 37). The total numbers of interactions of each Atlantic sturgeon DPS with try nets were estimated by multiplying the maximum percentage of each DPS comprising the Atlantic sturgeon stock in marine waters in the South Atlantic by the total number of estimated captures of Atlantic sturgeon by try nets (21 total captures; section 5.3.3.1). Based on the short tow times and lack of observed mortality, we do not believe Atlantic sturgeon will be killed in try nets.

Table 37. Estimated number of Atlantic sturgeon interactions with the South Atlantic shrimp fishery in federal waters by DPS based on 2009 effort data. GOM = Gulf of Maine DPS, NYB = New York Bight DPS, CB = Chesapeake Bay DPS, and SA = South Atlantic DPS.

DPS	Maximum Estimated Representation in the South Atlantic	Total Estimated Interactions with Try Nets in the South Atlantic Shrimp Fishery	Total Estimated Mortalities of Atlantic Sturgeon Interacting with Try Nets
GOM	9%	2	0
NYB	26%	6	0
CB	18%	4	0
Carolina	29%	7	0
SA	79%	17	0

5.3.4 Effects the Sea Turtle Conservation Regulations

Based on the available information, the use of TEDs in the shrimp trawl fisheries likely benefits Atlantic sturgeon. Anecdotal reports, including one from the South Atlantic shrimp fishery in 2001, indicate Atlantic sturgeon can utilize TEDs to escape capture in trawl nets. During TED testing conducted by the NMFS Southeast Fisheries Science Center, TEDs were estimated to exclude 87 percent of encountered sturgeon from capture by trawl nets. Therefore, the mandatory use of TEDs in the shrimp fisheries likely significantly increases the survival of Atlantic sturgeon encountering shrimp trawls in state and federal waters.

5.4 Effects on Gulf Sturgeon

In Sections 5.4.1- 5.4.3, we consider the effects of NMFS' authorizing shrimp trawling in the Gulf of Mexico EEZ on Atlantic sturgeon. In Section 5.4.4, we consider effects of NMFS' implementation of the sea turtle conservation regulations in the Gulf of Mexico. NMFS' authorization of shrimp trawling in the South Atlantic and its implementation of sea turtle conservation regulations in the South Atlantic both have no effect on Gulf sturgeon because the species' distribution within the action is restricted to the Gulf of Mexico portion of the action area.

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

Direct effects of NMFS - authorized shrimp trawling on Gulf sturgeon are expected to result from physical interactions with otter trawl gear use in the Gulf of Mexico federal shrimp fishery. The otter trawl is the only gear type used to harvest shrimp species in federal waters. Otter trawls are classified as active fishing gear because animals do not voluntarily enter the gear; they are either swept up from the seabed or netted from the water by the gear (NRC 2002). In this manner, Gulf sturgeon foraging within or moving through an active trawling location may be captured via envelopment or entanglement in the trawl's netting and subsequently injured or killed. Gulf sturgeon may also pass through TEDs unobserved. While this could greatly increase the survival of Gulf sturgeon interacting with shrimp trawls, it could also result in stress or injury to individuals passing through the TED.

5.4.2 Potential Factors Affecting the Likelihood and Frequency of Gulf Sturgeon Interactions with Trawl Gear

Based on our knowledge of both Gulf sturgeon and shrimp trawling in the Gulf of Mexico, the temporal and spatial overlap of Gulf sturgeon and the federal Gulf of Mexico shrimp fishery is very limited. Only adult Gulf sturgeon migrate into marine waters; other life stages have little to no movement into marine waters. Adult Gulf sturgeon are only susceptible to interaction with shrimp trawls during the 3-4 months (November through February) they spend feeding in the northern and the area known as the "Big Bend." During those winter months, because Gulf sturgeon are demersal (i.e., are found near the bottom of the water column), they are likely to be captured by shrimp trawls in those areas that drag their nets along the sea floor bottom. Data describing the Gulf sturgeon's swimming ability in the Suwannee River strongly indicated that they cannot continually swim against prevailing currents of greater than 1 to 2 m per second

(Wakeford 2001). Thus, even though shrimp trawls travel through the water at slow speeds, it is still highly unlikely that a Gulf sturgeon would be able to out swim a shrimp trawl. Relocation data indicate most Gulf sturgeon prefer sandy shoreline habitats in more shallow waters. The depth of the tow and observed Gulf sturgeon capture in federal waters was much deeper (17.3 m) (56.8 ft) than where Gulf sturgeon have previously been documented, showing that interactions can occur in deeper waters than previously believed. However, such deep-water interactions are still thought to be very rare, and the best available data indicate most sturgeon while in the Gulf remain inshore of where the federal fishery is prosecuted.

5.4.3 Estimating the Extent of Effects

5.4.3.1 Estimating Total Interactions and Captures

The federal fishery observer program was voluntary between 1992 through June 2007 with coverage typically less than 1% of total shrimp effort. No Gulf sturgeon were observed in a shrimp trawl during that period. Mandatory observer coverage was initiated in the Gulf of Mexico shrimp fishery in July 2007 and since then only two Gulf sturgeon have been observed captured, one in federal waters and one in state waters (Figure 8). Both of these captures were in main trawl nets in relatively shallow waters. The capture in federal waters (12/15/2009) was nearby the Gulf Islands where preferred winter foraging habitat is located.

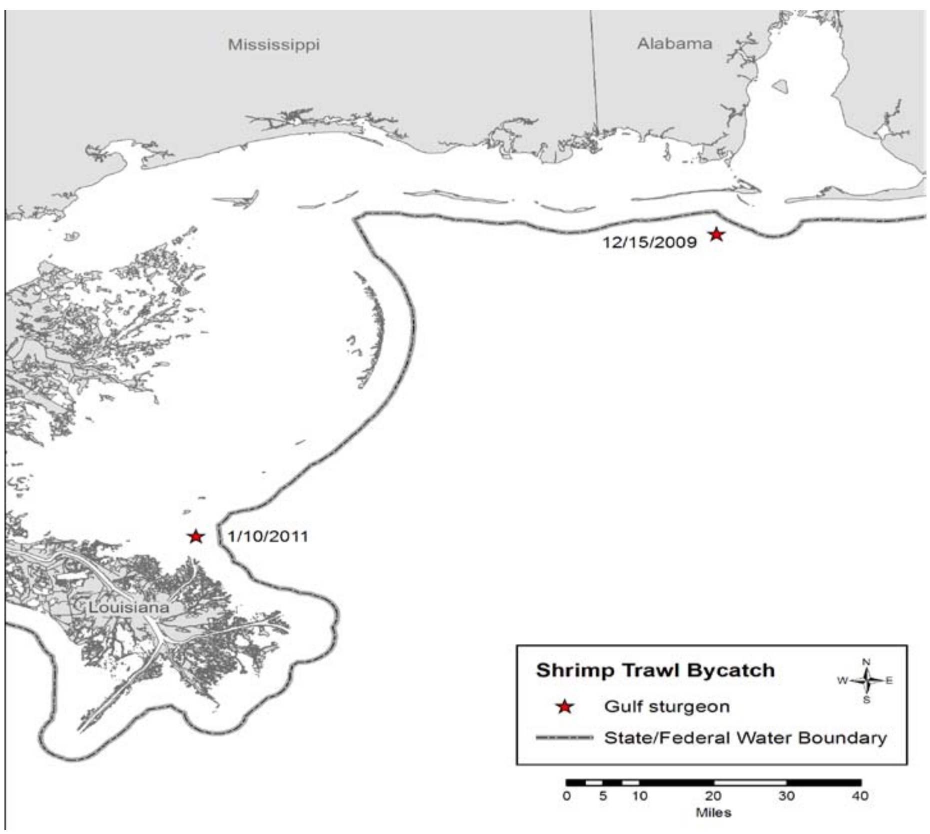

Figure 8. Location of observed Gulf sturgeon captures in shrimp trawls by date relative to state and federal fishing boundaries.

With only two Gulf sturgeon observed captured in NMFS' Shrimp Observer Program, attempting to extrapolate them to the Gulf of Mexico and then estimate the number of Gulf sturgeon captured by the federal fishery like we did for Atlantic sturgeon is inappropriate (i.e., too little data). However, given the low level of observer coverage (~2 percent since mandatory), it seems unreasonable to assume that the only captures in Gulf of Mexico shrimp fisheries in the past six years (July 2007 through March 2012) were the two observed. Also, based on the results of the Flexible Flatbar Flynet TED testing which documented 87 percent of Atlantic sturgeon escaping capture via escaping through the TED, the total number of Gulf sturgeon that interact with otter trawl gear in Gulf of Mexico shrimp fisheries is likely much higher than simply the number of Gulf sturgeon observed captured in shrimp trawl nets. With the limited available data, all we can we conclude is that observed captures will not exceed one per year; the number of actual interactions and the number resulting in captures are unknown.

5.4.3.2 Estimating Mortalities

Mortality of Gulf sturgeon when captured in trawls is expected to be very small. Relatively few sturgeon have been reported as captured in trawl nets, and of those, many were released alive. Louisiana Division of Wildlife and Fisheries (LADWF) documented 177 Gulf sturgeon incidentally captured reported by commercial fishermen in southeastern Louisiana during 199, of which 76 were captured in trawls, 10 in wing nets, and 91 in gillnet. LADWF noted an overall mortality rate of less than 1% (NMFS and USFWS 1995). Although this information is dated, more recently, LADWF Gulf sturgeon researchers indicated they are often contacted by fishers who wish to have the live sturgeon tagged and released (H. Rogillio, LADWF, Pers. Comm. 2002). Studies in a variety of trawl fisheries have shown that mortality of the conspecific Atlantic sturgeon incidentally caught in trawl gear is very low, with most surveys showing zero percent mortality (e.g. Stein et al. 2004). Although recent Atlantic sturgeon observed captures in the Southeast Shrimp fisheries documented 11% mortality, both of the Gulf sturgeon observed captured in shrimp trawls were released alive.

5.4.4 Effects of the Sea Turtle Conservation Regulations

Based on the available information, the use of TEDs in shrimp trawl fisheries likely benefits Gulf sturgeon by providing a route of escape. Reports indicate both Gulf and Atlantic sturgeon can utilize TEDs to escape capture in trawl nets. Recall the results of the Flexible Flatbar Flynet TED testing for Atlantic sturgeon where bycatch number was reduced by 87 percent. Therefore, the mandatory use of TEDs in the Gulf of Mexico shrimp fishery likely significantly decreases the number of Gulf sturgeon captured in shrimp trawls and most Gulf sturgeon encountering shrimp trawls in both state and federal shrimp fisheries will escape the nets alive.

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. 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 action area may affect sea turtles, smalltooth sawfish, Atlantic and Gulf sturgeon, and their habitats. Stranding data indicate sea turtles in the action area 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 proposed action. Numerous fisheries in state waters of the South Atlantic and Gulf of Mexico regions have also been known to adversely affect sea turtles, smalltooth sawfish, and Atlantic and Gulf sturgeon. The past and present impacts of these activates have been discussed in the Environmental Baseline section of this opinion. NMFS is not aware of any proposed or anticipated changes in these fisheries (excluding the southeastern shrimp fisheries) that would substantially change the impacts each fishery has on sea turtles, smalltooth sawfish, and Gulf sturgeon 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 activities that affect water quality and quantity such as farming) 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, smalltooth sawfish, and Atlantic and Gulf sturgeon covered by this opinion. NMFS will continue to work with states to develop ESA section 6 agreements and with researchers in section 10 permits to enhance programs to quantify and mitigate these takes. Therefore, NMFS expects that the levels of take of sea turtles, smalltooth sawfish, and Atlantic and Gulf sturgeon described for each of the fisheries and non-fisheries will continue at similar levels into the foreseeable future.

7.0 Jeopardy Analyses

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, smalltooth sawfish, or sturgeon species. In Section 5, we outlined how the proposed action would affect these species at the individual level and the extent of those effects in terms of the number of associated interactions, captures, and mortalities of each species to the extent possible with the best available data. Now we assess each of these species' response to this impact, in terms of overall population effects, 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 their continued existence.

"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 typically 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.

The NMFS and USFWS' ESA Section 7 Handbook (USFWS and NMFS 1998) defines *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." 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 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." 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.

All of our species analyses focus on the effects of lethal interactions attributed to the proposed action. Non-lethal interactions from the proposed action are not expected to have any measurable impact on the reproduction, numbers, or distribution on any species. We have approached the number of captures and mortalities conservatively to ensure that sea turtles, sawfish, and sturgeon that are likely to be seriously injured via interactions with shrimp trawls are counted as lethal interactions. The anticipated non-lethal interactions are not expected to impact the reproductive potential, fitness, or growth of any of the captured species because they will be released unharmed shortly after entering a trawl, or released with only minor injuries. The individuals are expected to fully recover such that no reductions in reproduction or numbers from the nonlethal interactions are anticipated. Also since these interactions may generally occur anywhere in the action area and would be released within the general area where each individual is caught, no changes in the distribution of any affected species are anticipated.

7.1 Loggerhead Sea Turtles

In Section 5, for all Southeast shrimp fisheries combined (i.e., otter, skimmer, and pusher-head trawls and wing (butterfly) and try nets) we produced a combined estimate of 81,620 interactions annually of which 7,701 were estimated to die. However, as explained in Section 5.1.6, these estimates are highly uncertain. The estimates rely on bycatch studies conducted in the late 1990s which even then were subject to many variables, assumptions, and biases because of data gaps. Thus, in our synthesis of effects on sea turtles (Section 5.1.7), we more generally concluded that the proposed action is anticipated to result in at least thousands and possibly tens of thousands of loggerhead sea turtle interactions annually, of which at least hundreds and possibly thousands are expected to be lethal. The vast majority of these loggerhead sea turtles are expected to be benthic juveniles with a 30:70 male/female ratio (NMFS-SEFSC 2009).

The lethal interactions associated with the proposed action represent 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 would be 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 proposed action. Because all the potential interactions 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 action area is expected to be unaffected.

Whether or not the reductions in loggerhead sea turtle numbers and reproduction attributed to the proposed action would appreciably reduce the likelihood of survival for loggerheads 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; NMFS-SEFSC 2009d)]. Below we synthesize what that information means in general terms and also in the more specific context of the proposed action and the environmental baseline.

Loggerhead sea turtles are a slow growing, late-maturing species. Because of their longevity, loggerhead sea turtles require high survival rates throughout their life to maintain a population. In other words, late-maturing 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 substantially impact 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 that the NWA loggerhead DPS is still large, but is possibly experiencing more mortality than it could withstand. All of the results of population models in both NMFS SEFSC (2009d) and Conant et al. (2009) indicated western North Atlantic loggerheads were likely to continue to decline in the future unless action was taken to reduce anthropogenic mortality. With the availability of newer nesting data beyond the 2007 data used in those analyses, the status of loggerhead nesting began to show improvement. As previously described in the Status of the Species section, in 2008 nesting numbers were high, but not enough to change the negative trend line. Nesting dipped again in 2009, but rose substantially in 2010. The 2010 Florida index nesting number was the largest since 2000. With the addition of data through 2010, the nesting trend for the NWA DPS of loggerheads is only slightly negative and not statistically different from zero (no trend) (NMFS and USFWS 2010). Additionally, although the best fit trend line is slightly negative, the range from the statistical analysis of the nesting trend includes both negative and positive growth (NMFS and USFWS 2010). The 2011 nesting was on par with 2010, providing further evidence that the nesting trend may have stabilized. It is important to note, however, that even if the trend has stabilized, overall numbers have a long way to go to meet the goals of the recovery plan.

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) concluded 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, and the results of new nesting trend analyses may indicate the positive effects of those efforts, serious bycatch problems still remain unaddressed.

Southeast shrimp fisheries have been taking large numbers of loggerheads sea turtles for decades and these takes are considered in all of the models used. Previously, skimmer trawl interactions and associated mortalities have gone unaccounted, despite concerns regarding the difficulty enforcing tow times and concerns that violations may result in large amounts of mortality.

The proposed action would significantly reduce bycatch mortality in skimmer trawls by requiring they use TEDs. As we noted in Section 5.1.4, our skimmer trawl estimates should not be considered explicit or definitive estimates of the number of animals actually captured, but as a reflection on anticipated scale of effects and thus, the relative impact of our proposed action. Those estimates indicate requiring skimmer trawls to use TEDs would result in an approximately 88 percent reduction in loggerhead sea turtle mortality in skimmer trawls.

Our new loggerhead bycatch estimates cannot be compared directly to the old 2002 estimates because of changing assumptions (e.g., capture rates associated with documented compliance versus a 100 percent compliance assumption) and incorporation of additional gear types (i.e., skimmer trawls and trynets). However, some inferences about anticipated effects can be made by recognizing those differences. First, our 2002 estimates were unrealistically low because they assumed 100 percent compliance with sea turtle conservation regulations which we have demonstrated has very likely never been the case. Anticipated TED compliance levels are at least the same, and more likely much better, than past average levels. Also, overall effort and otter trawl effort in southeastern shrimp fisheries are expected to remain near 2009 levels, which were undeniably substantially lower than in past decades. Anticipated skimmer trawl effort levels are also anticipated to remain near current levels. While current effort may be similar to that of several decades ago, they are still lower than they've been over the past decade, and substantial reductions in lethal loggerhead sea turtle interactions in skimmer trawls are anticipated from the proposed action.

The question we are left with for this analysis is whether the effects of the proposed action are too much, given the current status of the species and predicted population trajectories, and taking into account the impacts of the DWH oil release event, which is expected to have created at least a temporary change in the environmental baseline for the action area.

NMFS SEFSC (2009d) estimated the minimum adult female population size for the western North Atlantic 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 relevant five year period (2004-2008) (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, and therefore smaller pelagic stage individuals would occur in similar or even greater numbers.

As described in the Environmental Baseline section, we believe that the DWH oil release event had an adverse impact on loggerhead sea turtles, and resulted in mortalities to an unquantified number of individuals, along with unknown lingering impacts resulting from nest relocations, non-lethal exposure, and foraging resource impacts. However, there is no information to indicate, or basis to believe, that a significant population-level impact has occurred that would have changed the species' status to an extent that the expected interactions from southeast shrimp fisheries would result in a detectable change in the population status of the NWA DPS of loggerhead turtles. This is especially true given the size of the population and that, unlike Kemp's ridleys, the NWA DPS is proportionally much less intrinsically linked with the Gulf of Mexico.

It is possible that the DWH oil release event reduced that survival rate of all age classes to varying degrees, and may continue to do so for some undetermined time into the future. However, there is no information at this time that it has, or should be expected to have, substantially altered the long-term survival rates in a manner that would significantly change the population dynamics compared to the conservative estimates used in this opinion. Any impacts are not thought to alter the population status to a degree in which the number of mortalities from the proposed action could be seen as reducing the likelihood of survival and recovery of the species.

The Services' recovery plan for the Northwest Atlantic population of the loggerhead turtle (NMFS and USFWS 2008) which is the same as the NWA DPS, 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 proposed action are numbers 1, 2, 10, and 11:

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….
2. Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes.
10. Minimize bycatch in domestic and international commercial and artisanal fisheries.
11. Minimize trophic changes from fishery harvest and habitat alteration….

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 then declining trends of the Northern, Peninsular Florida, and Northern Gulf of Mexico Recovery Units. The recovery plan includes 8 different recovery actions directly related to the proposed action of this opinion.

Priority 1 actions (i.e., actions that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future) include:

- Monitor and reduce effort in the domestic commercial shrimp trawl fishery to minimize loggerhead bycatch (Priority 1).

Priority 2 actions (i.e., actions that must be taken to prevent a significant decline in species population/habitat quality or some other significant impacts short of extinction) include:

- Increase observer coverage to a statistically robust level to adequately monitor bycatch levels in the domestic commercial shrimp fishery and modify TED regulations if necessary.
- Promulgate regulations to require TEDs in all trynets in the domestic commercial shrimp.
- Implement statistically valid observer programs to determine bycatch levels in domestic commercial skimmer trawl fisheries and require TEDs if necessary.
- Investigate turtle exclusion rates for soft TEDs under field conditions using videography.
- Investigate the physiological effects of multiple captures and exclusions of loggerheads in domestic commercial shrimp trawls equipped with TEDs.

Priority 3 actions (i.e., actions necessary to provide for full recovery of the species) include:

- Continue efforts to educate domestic commercial shrimp fishers on the proper installation and use of larger-opening TEDs.
- Describe and characterize domestic commercial and recreational shrimp trawl fisheries.

Although multiple recent reviews and assessments of loggerheads [e.g., (Merrick et al. 2008; NMFS and USFWS 2008; Conant et al. 2009; TEWG 2009; Witherington et al. 2009; 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 detailed previously, more recent analyses have indicated that the trend may have stabilized (NMFS and USFWS 2010). 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, which may be what we are seeing with the latest data. However, the fact remains that NMFS-SEFSC (2009d), even though was completed prior to nesting data from 2008-2010, is still the most comprehensive demographic model to date and predicted 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 to still consider the effects of the action as if the population is still in an overall minor declining trend, even though it that the population may have stabilized. 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 WNA DPS, its total population remains large, and the trend may have stabilized, or at least has become only minimally negative. 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. As detailed previously, although the DWH event is expected to have impacted individuals within the Gulf of Mexico, there is no information at this time to indicate population-level impacts occurred that were significant enough to alter the population status in such a manner that it would change the relative impact of the proposed action on the NWA DPS.

We believe that the effects on loggerhead turtles associated with the proposed action are not reasonably expected to cause an appreciable reduction in the likelihood of survival of the NWA loggerhead DPS, even in light of the impacts of the DWH oil release event. We believe the currently large population is still under the threat of possible future decline until large mortality reductions in all fisheries and other sources of mortality (including impacts outside U.S. jurisdiction) are achieved and/or the impacts of past efforts are realized within the population. However, over at least the next several decades, we expect the western North Atlantic population of adult females 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 even if the population were still in a minor decline, 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 also not reasonably expected to cause an appreciable reduction in the likelihood of recovery of the NWA loggerhead DPS. Recovery is the process of removing threats so self-sustaining populations persist in the wild. The proposed changes to the sea turtle conservation regulations support or implement the Service's recovery plan developed for the NWA loggerhead DPS (NMFS and USFWS 2008). The proposed action would not impede 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.

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 what might be an already declining population can affect the potential for population growth, we believe because the effects of the proposed action would be less than those previously associated with southeast shrimp fisheries, they would not appreciably reduce the likelihood of a recovery that is not anticipated for 50-150 years. Additionally, we are cautiously optimistic that the previously seen declining trend may have stabilized based upon the most recent available data.

Continuation of the proposed action is not believed to be counter to the recovery plan's objective 10, "minimize bycatch in domestic and international commercial and artisanal fisheries." While the proposed action does not reduce interactions in southeast shrimp fisheries, it is designed to further minimize the impact of those interactions.

Conclusion
In conclusion, we believe that the effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of both the survival and recovery of the NWA loggerhead DPS in the wild. This analysis has been conducted in light of the most recently available information on its status as well as the environmental baseline that describes the environmental conditions that impact them, including what information we currently have available on the recent DWH oil spill event. Even if loggerhead sea turtles are still in decline, the remaining impacts from the proposed action will not appreciably affect the population's persistence into the future or its potential for recovery. The proposed action will reduce impacts compared to what has been occurring.

7.2 Green Sea Turtles

In Section 5, for all Southeast shrimp fisheries combined (i.e., otter, skimmer, and pusher-head trawls and wing (butterfly) and try nets) we produced a combined estimate of 13,876 interactions annually of which 1,382 were estimated to die. However, as explained in Section 5.6, these estimates are highly uncertain. In addition to the problems noted for our loggerhead sea turtle estimates, these estimates are based on the assumption that CPUE and population growth rate are linearly related which is of questionable validity (see Section 5.1.6 for more detail). Thus, in our synthesis of effects on sea turtles (Section 5.1.7), we more generally concluded that the proposed action is anticipated to result in at least thousands and possibly tens of thousands of green sea turtle interactions annually, of which at least hundreds and possibly thousands are expected to be lethal.

Lethal interactions 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 interactions would also result in a potential reduction in future reproduction, assuming some individuals would be females and would have survived otherwise 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 of which a small percentage is expected to survive to sexual maturity. The anticipated lethal interactions 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). Data from the index nesting beaches program in Florida substantiate 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, further dropping under 3,000 in 2009, but that consecutive drop was a temporary deviation from the normal biennial nesting cycle for green turtles, as 2010 saw an increase back to 8,426 nests on the index nesting beaches (FWC Index Nesting Beach Survey Database). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Tortuguero, Costa Rica, population growing at 4.9 percent annually.

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 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 exceeded through recruitment of new breeding individuals from successful reproduction of non-taken sea turtles. Since the abundance trend information for green sea turtles is clearly increasing, we believe the lethal interactions attributed to the proposed action will not have any measurable effect on that trend. As described in the Environmental Baseline section, although the DWH oil spill is expected to have resulted in adverse impacts to green turtles, there is no information to indicate, or basis to believe, that a significant population-level impact has occurred that would have changed the species' status to an extent that the expected interactions from southeast shrimp fisheries would result in a detectable change in the population status of green turtles in the Atlantic. Any impacts are not thought to alter the population status to a degree in which the number of mortalities from the proposed action could be seen as reducing the likelihood of survival and recovery of the species.

The Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991) 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 sea turtle nesting in Florida between 2001-2006 was documented as follows: 2001 – 581 nests, 2002 – 9,201 nests, 2003 – 2,622, 2004 – 3,577 nests, 2005 – 9,644 nests, 2006 – 4,970 nests. This averages 5,039 nests annually over those 6 years (2001-2006) (NMFS and USFWS 2007a). Subsequent nesting has shown

even higher average numbers (i.e., 2007 – 9,455 nest, 2008 – 6,385, 2009 – 3, 000, 2010 – 8,426 nests, 2011 – 10,701) thus this recovery criteria continues to be met.

- 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. Given the clear increases in nesting, however, it is likely that numbers on foraging grounds have increased by at least the same amount. This opinion's effects analysis assumes that in-water abundance has increased at the same rate as Tortuguero nesting.

The recovery plan includes 3 different recovery actions directly related to the proposed action of this opinion: (1) Implement and enforce TED regulations (Priority 1), (2) Promulgate regulations to reduce fishery related mortality (Priority 2), and (3) Provide technology transfer for installation and use of TEDs (Priority). The proposed action does all of these things, thus support continued implementation of the recovery plan.

Lethal interactions of green sea turtles attributed to the proposed action are not likely to reduce population numbers over time due to current population sizes and expected recruitment. The proposed action is expected to reduce effects. Despite the higher level of lethal interactions that occurred in the past, we have still seen positive trends in the status of this species. Thus, the proposed action is not likely to impede 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

Hawksbill sea turtles are the least affected sea turtle species by the proposed action. While we could not estimate the number of total hawsbill sea turtle interactions with the available data, we did produce an estimate of the number of lethal interactions; we conservatively estimated that no more than 71 mortalities would occur as a result of the proposed action. .As noted in our effects analysis, while we did attempt to limit the records included to those that could possibly be attributed to shrimp fisheries, it is likely that some and possibly most of these records are really attributable to other causes.

The possible lethal interactions of 71 hawksbill sea turtles 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. Potential lethal interactions could also result in a reduction in future reproduction, assuming one or more individuals would be female and would survive otherwise 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 any females could preclude the production of thousands of eggs and hatchlings, of which a fraction would otherwise survive to sexual maturity and contribute to future generations. 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. Likewise, as explained in the Environmental Baseline section, while a few individuals were found to have been impacted, there is no information to indicate, or basis to believe, that a significant population-level impact has occurred that would have changed the species' status to an extent that the expected interactions from southeast shrimp fisheries would result in a detectable change in the population status of hawksbill turtles in the Atlantic. Any impacts are not thought to alter the population status to a degree in which the number of mortalities from the proposed action could be seen as reducing the likelihood of survival and recovery of the species.

We believe hawksbill sea turtles have 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. Thus, we believe the proposed action will not result in an appreciable reduction in the likelihood of hawksbill sea turtles' survival 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.
- 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.

The recovery plan lists six major actions that are needed to achieve recovery, including:

- Provide long-term protection to important nesting beaches.
- Ensure at least 75 percent hatching success rate on major nesting beaches.
- Determine distribution and seasonal movements of turtles in all life stages in the marine environment.
- Minimize threat from illegal exploitation.
- End international trade in hawksbill products.
- Ensure long-term protection of important foraging habitats

Of the hawksbill sea turtle 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). 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).

Unlike for other sea turtle species, none of the major actions specified for recovery are specific to shrimp bycatch or even fishery bycatch in general. While incidental capture in commercial and recreational fisheries is listed as one of the threats to the species, the only related action, "Monitor and reduce mortality from incidental capture in fisheries" is ranked as a priority 3.

The potential effects on hawksbill sea turtles from the proposed action are not likely to reduce overall population numbers over time due to current population sizes and expected recruitment and the relatively low impact of shrimp fisheries on hawksbills. Our estimate of potential future mortalities is based our belief that the same level of take occurred in the past and with that level we have still seen positive trends in the status of these species. Thus, we believe the proposed action is not likely to impede the recovery objectives above and will not result in an appreciable reduction in the likelihood of hawksbill sea turtles' recovery in the wild.

7.4 Kemp's Ridley Sea Turtles

In Section 5, for all Southeast shrimp fisheries combined (i.e., otter, skimmer, and pusher-head trawls and wing (butterfly) and try nets) we produced a combined estimate of 437,833 Kemp's ridley sea turtle interactions annually of which 43,307 were estimated to die. However, as explained in Section 5.6, these estimates are highly uncertain. As with green sea turtles, in addition to the problems noted for our loggerhead sea turtle estimates, these estimates are based on the assumption that CPUE and population growth rate are linearly related which is of questionable validity (see Section 5.1.6 for more detail). Thus, in our synthesis of effects on sea turtles (Section 5.1.7), we more generally concluded that the proposed action is estimated to result in at least tens of thousands and possibly hundreds of thousands of Kemp's ridley sea turtle interactions, of which thousands and possibly tens of thousands are expected to be lethal annually. The vast majority of these Kemp ridley sea turtles are expected to be benthic juveniles.

The proposed action 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. The proposed action 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 females could preclude the production of thousands of eggs and hatchlings, of which a small 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.

Concentrated in the shallow waters of the Gulf of Mexico and Atlantic coast where shrimp pressure is also concentrated, Kemp's ridley sea turtles are the species most affected by shrimp trawls. However, the proposed action would significantly reduce bycatch mortality in skimmer trawls by requiring they use TEDs. As we noted in Section 5.1.4, our skimmer trawl estimates should not be considered explicit or definitive estimates of the number of animals actually captured, but as a reflection on anticipated scale of effects and thus, the relative impact of our proposed action. Those estimates indicate requiring skimmer trawls to use TEDs would result in an approximately 88 percent reduction in Kemp's ridley sea turtle mortality, saving potentially thousands of Kemp's ridley sea turtles from dying in skimmer trawls.

Whether the reductions in numbers and reproduction of Kemp's ridley sea turtles 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.

Heppell et al. (2005) predicted in a population model that the Kemp's ridley sea turtle population is expected to increase at least 12-16 percent per year and that the population could attain at least 10,000 females nesting on Mexico beaches by 2015. NMFS et al. (2011) contains an updated model which predicts that the population is expected to increase 19 percent per year and that the population could attain at least 10,000 females nesting on Mexico beaches by 2011. Approximately 25,000 nests would be needed for an estimate of 10,000 nesters on the beach, based on an average 2.5 nests/nesting female. In 2009 the population was on track with 21,144 nests, but an unexpected and as yet unexplained drop in nesting occurred in 2010 (13,302), deviating from the NMFS et al. (2011) model prediction. A subsequent increase to 20,570 nests in 2011 occurred, but we will not know if the population is continuing the trajectory predicted by the model until future nesting data is available. Of course, this updated model assumes that current survival rates within each life stage remain constant. The recent increases in Kemp's ridley sea turtle nesting seen in the last two decades is likely due to a combination of management measures including elimination of direct harvest, nest protection, the use of TEDs, reduced trawling effort in Mexico and the U.S., and possibly other changes in vital rates (TEWG 1998; TEWG 2000). While these results are encouraging, the species limited range as well as low global abundance makes it particularly vulnerable to new sources of mortality as well as demographic and environmental stochasticity all of which are often difficult to predict with any certainty.

Kemp's ridleys mature and nest at an age of 7-15 years, which is earlier than other sea turtles. A younger age at maturity may be a factor in the response of this species to recovery actions. The required use of TEDs in shrimp trawls in the U.S. under the sea turtle conservation regulations and in Mexican waters has had dramatic effects on the recovery of Kemp's ridley sea turtles. Kemp's ridley sea turtles total mortality (all sources) declined by about one-third with the early implementation of TEDs. After 1996, with our TED regulations improvement in 1995 and 1996 focused on effectiveness for Kemp's and our improved enforcement and outreach (requirements of a 1994 RPA), mortality declined by almost 60 percent compared to pre-TED levels.

The proposed action is expected to continue and improve the sea turtle conservation regulations through requiring skimmer trawls to also use TEDs. Requiring TEDs in skimmer trawls is expected to reduce Kemp's ridley sea turtle mortality in that shrimp fishing sector TED by 88 percent and potentially save over 5,000 sea turtles. This may be particularly important if sea turtle abundance increases do lead to linear increases in Kemp's ridley sea turtle CPUEs as minimizing mortality will then be essential.

Although the number of mortalities attributed to shrimp trawls may be very large, clearly the population is able to compensate for that mortality, given such high predictions.

It is likely that the Kemp's ridley sea turtle was the sea turtle species most affected by the DWH oil spill on a population level. In addition, the sea turtle strandings documented in 2011 in Alabama, Louisiana, and Mississippi primarily involved Kemp's ridley sea turtles (see

Environmental Baseline section). Nevertheless, the effects on Kemp's ridley sea turtles from the proposed action are not likely to appreciably reduce overall population numbers over time due to current population sizes, expected recruitment, and continuing strong nesting numbers (including, based on preliminary information, in 2011), even in light of the adverse impacts expected to have occurred from the DWH oil spill and the strandings documented in 2011. The proposed action is expected to further reduce the effects of Southeastern shrimp fisheries from past levels. It is worth noting that despite higher levels of effects in the past, we have still seen tremendous growth in the population. Thus, we believe the proposed action is will not result in an appreciable reduction in the likelihood of Kemp's ridley sea turtles' survival in the wild.

The recovery plan for the Kemp's ridley sea turtle (NMFS et al. 2011) lists the following relevant recovery objectives:

- A population of at least 10,000 nesting females in a season (as measured by clutch frequency per female per season) distributed at the primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) in Mexico is attained. Methodology and capacity to implement and ensure accurate nesting female counts have been developed.

NMFS and USFWS (2011) states "the highest priority needs for Kemp's ridley recovery are to maintain and strengthen the conservation efforts that have proven successful. In the water, successful conservation efforts include maintaining the use of turtle excluder devices (TEDs) in fisheries currently required to use them, expanding TED-use to all trawl fisheries of concern, and reducing mortality in gillnet fisheries. Adequate enforcement in both the terrestrial and marine environment also is also noted essential to meeting recovery goals."

We believe the proposed action supports 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.

The recovery plan states average nests per female is 2.5 and recovery goal of 10,000 nesting females is associated with 25,000 nest. About 30,000 nests are indicative of 10,000 nesting females in a season (NMFS and USFWS 2007c). As of February 2011, 13,302 nests had been observed in the States of Tamaulipas, Mexico (Gladys Porter Zoo 2011). A small nesting population is emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 128 in 2007, and a record 197 in 2000 (National Park Service data).

The proposed action will expand TED-use to skimmer trawls, butterfly nets, and wing nets and is expected to reduce Kemp's ridley sea turtle mortality by 88 percent. The proposed action will also reduce Kemp's ridley sea turtle mortalities attributed to southeast shrimp fisheries by improving long-term compliance with the sea turtle conservations by establishing a compliance standard.

The estimated number of interactions provided in section 5 are highly uncertain and are unlikely to accurately represent actual interactions occurring in shrimp trawls in the southeastern US. Assuming, as a worst case scenario, that the conservative approach taken in the analysis is accurate, and the numbers accurately reflect what is actually occurring, the interactions represent large number of animals. Based on what we know about historical shrimp trawling effort, i.e., that there has been much higher effort in the recent past, it is likely that even larger numbers of turtles were being impacted by shrimp trawls for the past decade or more. Despite this fact, estimated population size has continued to increase. In light of these facts, NMFS does not believe that the continued take at these levels is likely to jeopardize either the survival or recovery of Kemps' ridley sea turtles.

7.5 Leatherback Sea Turtles

In Section 5, for all Southeast shrimp fisheries combined (i.e., otter, skimmer, and pusher-head trawls and wing (butterfly) and try nets) we produced a combined estimate of 1,393 leatheracbk interactions annually of which 144 were estimated to die. However, as explained in Section 5.6, thse estimates are highly uncertain. Thus, in our synthesis of effects on sea turtles (Section 5.1.7), we more generally concluded that the proposed action is anticipated to result in a relatively small number leatherback sea turtle lethal interactions compared to Kemp's ridley and loggerhead sea turtles. Due to the offshore habits of leatherback sea turtles, these interactions are anticipated to only occur in shrimp otter trawls.

The lethal take of leatherback sea turtles would reduce their respective populations compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. The lethal takes could also result in a potential reduction in future reproduction, assuming one or more of these individuals would be female and would have survived otherwise 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 any female leatherbacks that would have survived otherwise to reproduce would eliminate its and its future offspring's contribution to future generations. The anticipated lethal interactions are expected to occur anywhere in the offshore portion of the action area. Given these sea turtles generally have large ranges in which they disperse, no reduction in the distribution of leatherback sea turtles is expected from the proposed action.

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). 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).

We believe the proposed action is not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of leatherback sea turtles in the wild. Although the anticipated mortalities would result in a reduction in absolute population numbers, it is not likely this reduction would appreciably reduce the likelihood of survival of this 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 sea turtles unaffected by the proposed action. 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 proposed action is not likely to have any measurable effect on overall population trends. These trends already reflect the past impact of southeastern shrimp fisheries and the proposed action is expected to control those impacts by maintaining compliance levels. As explained in the Environmental Baseline section, although no direct leatherback impacts (ie. oiled turtles or nests) from the DWH oil spill in the northern GOM were observed, some impacts from that event may be expected. However, there is no information to indicate, or basis to believe, that a significant population-level impact has occurred that would change the species' status to an extent that the expected interactions from southeast shrimp fisheries would result in a detectable change in the population status of leatherback sea turtles. Any impacts are not thought to alter the population status to a degree in which the number of mortalities from the proposed action could be seen as reducing the likelihood of survival and recovery of the species.

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.

We believe the proposed action is not likely to impede the recovery objectives above and will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild.

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 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).

Lethal interactions of leatherback sea turtles from the proposed action are not likely to reduce population numbers over time due to current population sizes and expected recruitment. Additionally, our estimate of future take is expected to be less than the level of take that occurred in the past. It is worth noting that despite that past higher level of take, we have still seen stable or increasing trends in the status of the species in most Atlantic populations.

The recovery plan includes one recovery action, a priority one task, directly related to the proposed action of this opinion: Implement measures to reduce capture and mortality from commercial shrimp vessels. The proposed action, by improving long-term compliance with the 2002 TED regulations which were designed in part to aid release of large leatherback sea turtles, supports the continued implementation of this recovery task.

7.6 Smalltooth Sawfish

This section analyzes the effects of the action on the likelihood of survival and recovery of smalltooth sawfish in the wild. In this context, the survival of a species considers its current risk of extinction and how that may be increased by the proposed action. In the following analysis, we demonstrate that the level of captures and mortalities in the federal shrimp fishery (i.e., 240 (non-lethal) and 90(lethal) takes of smalltooth sawfish over a three-year period) will not appreciably reduce the species' likelihood of survival and recovery in the wild.

Although lethal take will result in an instantaneous reduction in absolute population numbers, the U.S. DPS population of smalltooth sawfish would not be appreciably affected. The taking of 90 sub-adult/adult animals is significant for a population that is currently at a level less than 5% of its size at the time of the European settlement. Available data summarized in Section 3 indicates the smalltooth sawfish population is stable or increasing (Carlson and Osborne 2012). Using a demographic approach and life history data from similar species, Simpfendorfer (2000) estimates the most likely range for the intrinsic rate of increase is 0.08 per year to 0.13 per year with population doubling times of 10.3 to 13.5 years. Although this rate is very slow, the lethal take of 90 sub-adult/ adult males or females over a three-year period is not expected to have any measureable impact on this rate of population doubling-time. This is because effort and associated smalltooth sawfish mortality in the federal shrimp has decreased significantly from the amount that existed when that doubling rate was measured. Even with the ongoing fishing activities associated with the federal shrimp fishery, the smalltooth sawfish population still remains stable or increasing (Carlson and Osborne 2012). This lethal take could also result in a potential reduction in future reproduction if that individual taken was a female and would have survived other threats and reproduced in the future. Reduction in the distribution of the smalltooth sawfish would not occur, as 90 lethal captures over a three-year period will not have a bearing on the overall distribution of the species.

Whether the reduction in numbers and reproduction of smalltooth sawfish attributed to the federal shrimp fishery would appreciably reduce the species' likelihood of recovering depends on the probable effect the changes in numbers and reproduction would have on the population's growth rate, and whether the growth rate would allow the species to recover.

The following analysis considers the effects of the take on the likelihood of recovery in the wild. The U.S. DPS of Smalltooth Sawfish Recovery Plan (NMFS 2009) identifies two relevant recovery objectives over a period of 100 years:

- Minimize human interactions and associated injury and mortality.
- Ensure smalltooth sawfish abundance increases substantially and the species reoccupies areas from which it had been previously extirpated.

The Recovery Plan anticipates that, with full implementation of the Recovery Plan, the U.S. DPS of smalltooth sawfish will recover within 100 years. The Recovery Plan includes multiple recovery actions that are particularly relevant to the proposed action of this opinion:

1.1.1 Monitor the take and fate of the species in commercial and recreational fisheries throughout the species' range.

1.1.2 Improve the capacity and geographic coverage of the sawfish encounter data collection program to enable full investigation, review, and evaluation of each report of smalltooth sawfish fishery interactions.

1.1.3 Determine the post-release mortality of smalltooth sawfish from various types of fishing gear.

1.1.4 Integrate collection of data on smalltooth sawfish into current commercial fishery observer programs and implement new programs where required.

1.1.6 Implement and adequately fund observer programs over the long term.

1.1.7 Use PVA or other types of population models to evaluate the effect of fishery takes on the species' viability.

1.1.8 Implement strategies to reduce bycatch, mortality, and injury, in specific fisheries to ensure the species' viability.

1.1.15 Monitor trawl fisheries to ensure they do not threaten the viability of the population.

1.1.16 Investigate fishing devices, gear modifications, and techniques (physical, electronic, chemical, net configuration, etc.) that reduce the likelihood of sawfish capture, improve the chances of sawfish escapement, minimize harm to sawfish and humans from capture, and facilitate successful release of healthy sawfish.

1.1.17 Recommend the use of fishing devices, gear modifications, and/or techniques found to be effective at reducing bycatch of smalltooth sawfish and/or mitigating the effects of capture in areas frequented by sawfish, other important sawfish habitats, and in trawl fisheries encountering significant numbers of sawfish.

1.3.3 Develop, distribute, and implement Safe Handling and Release Guidelines for smalltooth sawfish for recreational and commercial fisheries to minimize interactions, injury, and mortality.

2.3.2 Investigate short-term movement patterns of adult sawfish to provide information on habitat use patterns.

2.3.4 Investigate seasonal patterns of occurrence and habitat use of adults.

2.3.6 Monitor abundance of adult smalltooth sawfish in aggregation areas.

3.2.1 Assess the east and west coasts of Florida to determine the most appropriate location and timing of surveys for adult smalltooth sawfish.

3.2.2 Evaluate fishery observer programs to determine their suitability to act as surveys of relative abundance of adult smalltooth sawfish.

3.2.4 Conduct regular surveys to determine the relative abundance of smalltooth sawfish off the east and west coasts of Florida.

3.2.5 Analyze annual relative abundance data for adult smalltooth sawfish and determine if it meets the criteria in Objective 3.

3.2.6 Conduct tagging studies, potentially using satellite and/or archival technology, to study seasonal migrations along the U.S. east coast and within the Gulf of Mexico.

3.2.7 Continue existing effective sawfish encounter reporting systems with outreach efforts throughout the historic range, with special efforts focused on the north central Gulf of Mexico, Georgia, South Carolina, and North Carolina.

NMFS is currently funding several actions identified in the Recovery Plan for smalltooth sawfish; adult satellite tagging studies, the NSED, and monitoring take in commercial fisheries. Additionally, NMFS has developed safe handling guidelines for the species. Despite the ongoing threats from the federal shrimp fisheries, we have still seen a stable or slightly increasing trend in the status of this species. Thus, the proposed action is not likely to impede the recovery objectives above and will not result in an appreciable reduction in the likelihood of the U.S. DPS of smalltooth sawfish’s recovery in the wild. NMFS must continue to monitor the status of the population to ensure the species continues to recover. Based on the best available information, we conclude the proposed action is not likely to jeopardize the continued existence of this species.

7.7 Atlantic sturgeon

The majority of Atlantic sturgeon interacting with otter trawl gear in the South Atlantic shrimp fishery in federal waters are expected to survive, with little or no injury, because of the ability of Atlantic sturgeon to evade capture by escaping through TEDs. Though one to eight Atlantic sturgeon from each of the five DPSs may interact with a try net (see Table 5.3.2), no mortality is anticipated. The expected lethal take of up to nine Atlantic sturgeon by the South Atlantic shrimp fishery in federal waters, with one to eight lethal takes of Atlantic sturgeon originating from each of the five DPSs, would result in a reduction in numbers within each DPS, each of which are already considered to be low. However, the loss of these numbers of individuals will not significantly decrease the overall populations of the DPSs. No changes in the distribution of Atlantic sturgeon are expected from lethal takes attributed to the proposed action. Because all of the potential interactions are expected to occur at random throughout the proposed action area and Atlantic sturgeon are known to disperse widely in the marine environment, the distribution of Atlantic sturgeon in the action area is expected to be unaffected. Additionally, shrimping in federal waters is not expected to have adverse effects on marine habitat utilized by Atlantic sturgeon and will have no effect on spawning, nursery, or foraging habitat found in rivers and estuaries. NMFS believes that the proposed action is not likely to cause a reduction in reproduction. Atlantic sturgeon spawn in the far upstream portions of rivers, while the federal shrimp fishery in the South Atlantic occurs at least 3 miles offshore. Based on this information, we believe the removal of a total of nine Atlantic sturgeon, with one to eight adult Atlantic sturgeon being removed from each DPS annually, will cause a reduction in numbers, but will not affect their distribution or reproduction. We do not believe the reductions in numbers are likely to reduce the population's ability to persist into the future. Based on this information, the proposed action will not appreciably reduce the likelihood of the five Atlantic sturgeon DPS's survival within their ranges.

Because of the recent listing of the five DPSs of Atlantic sturgeon, a recovery plan for the species has not yet been developed. However, recovery is the process by which listed species and their ecosystems are restored, and their future is safeguarded to the point that protections under the ESA are no longer needed. The first step in recovering a species is to reduce identified threats; only by alleviating threats can lasting recovery be achieved. An increase in the population to a size that maintains a steady recruitment of individuals representing all life stages would provide population stability and enable the population to sustain itself even in the event of unforeseen and unavoidable impacts. Major threats affecting the five Atlantic sturgeon DPSs were summarized in the final listing and include:

1) Dredging that can displace sturgeon while it is occurring and affect the quality of the habitat afterwards by changing the depth, sediment characteristics, and prey availability.

2) Degraded water quality in areas throughout the range of the five DPSs as a result of withdrawals for public use, runoff from agriculture, industrial discharges, and the alteration of river systems by dams and reservoirs.

3) Impeded access to historical habitat by dams and reservoirs.

4) Bycatch of Atlantic sturgeon in commercial fisheries.

5) Vessel strikes in within the riverine portions of the range of the New York Bight and Chesapeake Bay DPSs.

6) Inadequacy of regulatory mechanisms to control bycatch and the modification and curtailment of Atlantic sturgeon habitat.

While bycatch of Atlantic sturgeon from each of the DPSs is expected to occur in federal waters, mortality associated with the South Atlantic shrimp fishery is expected to be very low. The use of TEDs will reduce the degree of bycatch of Atlantic sturgeon that occurs and increase the survival of Atlantic sturgeon that interact with the South Atlantic shrimp fishery. We therefore conclude the proposed action will not appreciably diminish the likelihood of recovery for any of the five DPSs of Atlantic sturgeon.

7.8 Gulf Sturgeon

In Section 5, with the limited available data, all we were able to conclude is that observed captures will not exceed one per year; the number of actual interactions and the number resulting in captures are unknown. However, because we believe the temporal and spatial overlap of Gulf sturgeon and the federal Gulf of Mexico shrimp fishery is very limited, few Gulf sturgeon are expected to interact with the federal shrimp fishery conducted in the Gulf of Mexico. Of the few that do interact with the otter trawl gear, the majority are expected to survive, with little or no injury, given their ability to escape capture by passing through TEDs that are required under the proposed action. The majority of the Gulf sturgeon captured by federal shrimp trawls are also expected to be released alive. Thus, although the loss of any adult Gulf sturgeon will reduce number and reproductive output, the reduction is not likely to appreciably reduce the likelihood of survival and recovery for Gulf sturgeon. Number of individuals within each riverine populations is variable across their range, but generally over the last decade (USFWS and NMFS 2009) populations in the eastern part of the range (Suwannee, Apalachicola Choctawhatchee) appear to be relatively stable in number or have a slightly increasing population trend. The loss of a small numbers of individuals will not significantly decrease the overall population of Gulf sturgeon or change its distribution. Thus, NMFS believes that the proposed action is not likely to jeopardize the continued existence of Gulf sturgeon.

8.0 Conclusion

We have analyzed the best available data, the current status of the species, the environmental baseline, the effects of the proposed action, and cumulative effects to determine whether the proposed action is likely to jeopardize the continued existence of any listed species. Our green, hawksbill, and leatherback 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 these Atlantic sea turtles 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 of these Atlantic populations of sea turtles, it is our opinion that the proposed action is not likely to jeopardize the continued existence of green (both the Florida Breeding Population and non-Florida breeding population), hawksbill, or leatherback sea turtles. Our other analyses focused on the full listed entity. Based on those analyses, it is also our opinion that the proposed action is not likely to jeopardize the continued existence of Kemp's ridley sea turtles, loggerhead sea turtles (the Northwest Atlantic Ocean DPS), Atlantic sturgeon (Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, or South Atlantic DPSs), Gulf sturgeon, or smalltooth sawfish (U.S. DPS).

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 RPMs and terms and conditions of the ITS. Take that occurs while fishing not in compliance with the requirements of the proposed action does not constitute authorized incidental take because it is not incidental to an otherwise lawful activity. Accordingly, such take is not covered by the ITS and constitutes unlawful take.

Section 7(b)(4)(c) of the ESA specifies that to provide an ITS 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 protected marine mammals is provided and no take is authorized. F/SER2 must immediately notify NMFS' Office of Protected Resources should a take of a listed marine mammal occur.

This opinion establishes an ITS with RPMs and terms and conditions for incidental take coverage for sea turtle takes throughout the action area and for Atlantic sturgeon and smalltooth sawfish takes in the federal shrimp fishery. NMFS has not issued a 4(d) rule prohibiting the take of threatened Gulf sturgeon so no incidental take coverage is needed, despite expected takes in the federal fishery. However, if new information indicates effects are greater than those anticipated in Section 5.4 that were the basis for our jeopardy analysis in Section 7.8, consultation must be reinitiated.

9.1 Anticipated Amount or Extent of Incidental Take

Section 7 of the ESA requires ITSs to specify the "impact" of the incidental takings on the species (16 U.S.C. § 1536(b)(4)(i)). In its discussion of §7(b)(4), Congress indicated that it preferred the ITS to contain a numerical value: "Where possible, the impact should be specified in terms of a numerical limitation on the Federal agency or permittee or licensee." (H.R.Rep. No. 97-567, at 27 (1982), reprinted in 1982 U.S.C.C.A.N. 2807, 2827). Congress recognized, however, that a numerical value would not always be available: "…The Committee intends only that such numbers be established where possible." Id.

Unlike other fisheries, direct observer data cannot be used to determine the numbers of sea turtles taken in the shrimp fisheries. As explained in more detail in Section 5.1.3.2, this is due in large part to inability to observe most sea turtle takes via conventional observer programs. TEDs properly used in otter trawls result in the release of the vast majority of sea turtles underwater where they are unobservable. Sea turtles that fail to escape through the TED can go undocumented by observers due to the animals falling out of non-compliant TEDs during haul back of the gear. This event is more likely to occur with high-angle TEDs (>55 degrees) than other types of violations because sea turtles can become impinged on reflector bars due to water against the carapace, particularly juveniles which have less strength to overcome drag. While “ghost captures” are less likely to occur with top-opening TEDs, SEFSC gear specialists have observed large-frame top-opening TEDs without flotation rolling over (inverting) at the surface which could also result in turtles falling out of the opening even in top opening TEDs. In addition, some of the captured sea turtles may fall out of the front of the net as the lazy line is used to haul up the codend of the net. These sea turtles may or may not be observed depending on conditions (e.g., high sea state or at night) and where the observer is positioned aboard the vessel. Waters fished for shrimp in the action area tend to be very murky, thus even turtles falling out near the surface can be easily missed.

We also have not been able to reliably quantify the anticipated amount of take of sea turtles, using the best available information. The last real physical observations of fishery interactions are based on “naked net” studies conducted in the late 1990s. These studies, which were used as the basis for the estimates generated in 2002 and which were then subject to many variables, assumptions, and biases to overcome data gaps, are now nearly fifteen years old. It is not possible to update the survey data in order to estimate the number of takings as to collect such data is cost prohibitive. According to estimates by the SEFSC it would cost approximately 14 million dollars to gather all the information necessary to develop reliable estimates for the entire action area. We believe using catch rate and aerial survey data that have not been updated in over a decade is inappropriate because we expect sea turtle populations have changed over the last decade.

In trying to determine numerical take values we attempted to update the data, described above, to reflect documented dramatic increases in abundance in Kemp’s ridleys and greens. To do this we had to assume that CPUE and population growth rate are linearly related, which is of questionable validity because small changes in this relationship could have large impacts on the catch and mortality estimates, meaning this relationship is most likely not linear. For this reason and others as described in more detail in Section 5 of this document, we could not reliably determine actual take numbers for sea turtle species adversely affected by the Southeastern shrimp fisheries. Therefore, our jeopardy analyses for these species were largely qualitative using our knowledge of sea turtle population trends based on nesting and other information and relating that information to the magnitude of the effects of the industry based on effort and compliance.

For the ITS to be valid, we must have a procedure to determine if the impacts of our proposed action exceed those expected based on our analysis in section 5 in this opinion and subsequently used in our jeopardy analyses for the affected sea turtle species. Even if we could reliably estimate take, we cannot effectively monitor take relative to these numbers. The only reliable means of monitoring and limiting take, which is necessary to know that impacts analyzed have not been exceeded or that reinitiation is required, is monitoring effort and compliance. Effort and compliance are readily observable and are two of the variables that greatly influence our estimate as well as actual take. We therefore propose to monitor effort and TED compliance to insure compliance with the ITS and determine the need to reinitiate consultation if take has been exceeded. We propose to use these two parameters because effort is directly related to the number of turtles that interact with shrimp trawls, and compliance is directly related to the number of turtles captured and how many of those turtles are supsequently killed.

We believe that the most effective way to monitor effects is to compare future annual effort and compliance levels to our anticipated effort estimates and compliance levels. Our sea turtle effects analyses were based on the most recent effort data available[5] because anticipated annual effort in southeast shrimp fisheries is not expected to increase in the future. Therefore, we will use those levels (i.e. 132,900 days fished in the Gulf of Mexico [based on 108,501 days fished for otter trawls in 2009 and 24,399 days fished for skimmer trawls] and 14,560 trips in the South Atlantic [based on 13,464 trips for otter trawls in 2009 and 1,096 trips for skimmer trawls in 2009 or 2010[6]), as our baseline. Similarly, future compliance levels are expected to result in TEDs being 88 percent effective, thus that level will be used as our compliance baseline. The methods on how these parameters must be monitored are described in detail in the RPMs and their implementing terms and conditions. At the end of each year, both the effort and compliance data must be analysed using the methods we used in our analysis in Section 5 of this document to determine if the effects of the proposed action on sea turtle species exceed these predicted baseline levels. If we exceed these effort or compliance levels, we will infer that take has been exceeded and that effects on sea turtles were greater than analyzed. If sea turtle effects exceed those in this opinion for any given year then NMFS, in its action agency capacity, must decide to either reinitiate consultation or engage in rule making to address the activities leading to the greater effects.

Unlike for sea turtles, we are able to monitor the number of Atlantic sturgeon and smalltooth sawfish incidental takes that are anticipated to result from the proposed action by extrapolating observed interactions to the entire fleet using effort data. This is because for these species we are able to infer the number of unobservable interactions that pass through TEDs using the number of observed captures and experimental research on sturgeon TED exclusion rates. There is no data to suggest that Atlantic sturgeon or smalltooth sawfish captured in trawl nets go unobserved and unaccounted for because of fall out during haul back or the other problems we discussed for sea turtles. In the case of smalltooth sawfish, none are expected to be excluded by TEDs, so all smalltooth sawfish interactions are expected to be observable.

The numbers presented for Atlantic sturgeon and smalltooth sawfish represent total takes over three-year periods. Annual take estimates of these species can have high variability because of natural and anthropogenic variation and because observed interactions are relatively rare. As a result, monitoring fisheries using 1-year estimated take levels based on observer data is largely impractical. 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. 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

[5]Prior to completion of this opinion, more recent data (i.e. 2010) have become available, but document effort in 2010 was less than in 2009 (J. Nance, SEFSC, pers. comm.).

[6] 2009 data was used for skimmer trawl effort in the Gulf of Mexico and 2010 data was used for skimmer trawl effort in the South Atlantic (i.e. North Carolina).

accurate assessment of how the proposed action is affecting these species versus our expectations.

Table 9.1 Anticipated Takes

Species	Otter Trawl Interactions, Captures, and Mortalities	Try Net Interactions,[**] Captures, and Mortalities	Otter trawl and Try Net Combined interactions, Captures, and Mortalities
Atlantic Sturgeon	1722 total interactions, including 222 captures of which 27are expected to be lethal every three years[*], with DPS limits as follows: • Gulf of Maine DPS ≤ 153 interactions, including 21 captures, of which 3 are expected to be lethal • New York Bight DPS ≤ 441 interactions, including 57 captures, of which 9 are expected to be lethal • Chesapeake Bay DPS ≤ 306 interactions, including 42 captures, of which 6 are expected to be lethal • Carolina DPS ≤ 489 (9) interactions, including 66 captures, of which 9 are expected to be lethal • South Atlantic DPS ≤ 1332 interactions, including 174 captures, of which 24 are expected to be lethal	21 total interactions, all resulting in capture and of which none are expected to be lethal every three years[*], with DPS limits as follows: • Gulf of Maine DPS ≤ 3 interactions all resulting in capture and of which none are expected to be lethal • New York Bight DPS ≤ 9 interactions all resulting in capture and of which none are expected to be lethal • Chesapeake Bay DPS ≤ 6 interactions, all resulting in capture and of which none are expected to be lethal • Carolina DPS ≤ 9 (0) interactions all resulting in capture and of which none are expected to be lethal • South Atlantic DPS ≤ 24 interactions all which resulting in capture and of which none are expected to be lethal	1731 total interactions, including 243 captures of which 27are expected to be lethal every three years[*], with DPS limits as follows: • Gulf of Maine DPS ≤ 156 interactions, including 24 captures, of which 3 are expected to be lethal • New York Bight DPS ≤ 450 interactions, including 66 captures, of which 9 are expected to be lethal • Chesapeake Bay DPS ≤ 312 interactions, including 48 captures, of which 6 are expected to be lethal • Carolina DPS ≤ 498 interactions, including 75 captures, of which 9 are expected to be lethal • South Atlantic DPS ≤ 1356 interactions, including 198 captures, of which 24 are expected to be lethal
Smalltooth Sawfish	240 (90) every three years	--	240 (90) every three years

*Incidental take will be monitored based on the three-year running totals (e.g., 2012-2014, 2013-2015)
** All try net interactions result in captures

9.2 Effect of the Take

NMFS has determined the level of anticipated take associated with the proposed action and exempted from ESA section 9 take prohibitions in this ITS is not likely to jeopardize the continued existence of green, hawksbill, Kemp's ridley, leatherback, or loggerhead (NWA DPS) sea turtles, Atlantic sturgeon (any DPS), or smalltooth sawfish (U.S. DPS)[7].

9.3 Reasonable and Prudent Measures (RPMs)

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of Kemp's ridley, green, loggerhead, leatherback, and hawksbill sea turtles:

1) NMFS must monitor effort in state and federal fisheries and continue to work to better determine their effects on sea turtles.

2) NMFS must monitor TED compliance and must ensure compliance with TED regulations is at the anticipated levels in the ITS of this opinion.

3) NMFS must continue to coordinate with the sea turtle standing and salvage network (STSSN) and the states to monitor strandings and work to improve the utility of the stranding database for monitoring effects of shrimp fisheries.

4) NMFS must continue outreach programs to train fishermen and net shop personnel in the proper installation and use of TEDs and continue to work with industry on gear and TED development.

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of smalltooth sawfish:

5) NMFS must conduct research to better understand the nature of smalltooth sawfish interactions with shrimp trawls.

6) NMFS must conduct outreach to fishers that fish in Southwest and South Florida to ensure that they know and use the safe handling guidelines for sawfish release to minimize post release mortality.

NMFS believes the following reasonable and prudent measure is necessary and appropriate to minimize impacts of incidental take of Atlantic sturgeon:

7) NMFS must conduct research to better understand the nature of Atlantic sturgeon interactions with the shrimp fishery.

9.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, NMFS must comply with the following terms and conditions, which implement the reasonable and prudent measures

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[7] NMFS has also determined that the proposed action is not likely to jeopardize Gulf sturgeon, but because NMFS not issued a 4(d) rule prohibiting the take of threatened Gulf sturgeon, no incidental take exemption is need for the anticipated takes in the federal fishery.

described above and outline required reporting and monitoring requirements. These terms and conditions are nondiscretionary.

The following terms and conditions implement RPM No. 1.

1) NMFS must coordinate with the states to monitor shrimp fishing effort in major gear types and must use this information to determine trends in shrimp fisheries and possible effects of these trends on sea turtles.

   a) NMFS must encourage states to revise their licensing or work on other alternatives as needed to include specific gear types used (e.g., identify otter trawl versus skimmer trawl) and to allow for estimation of the active number of vessels by gear type and make progress on accounting for latent permits.
   b) NMFS must produce a report documenting total shrimp trawl effort by major gear type (i.e., otter trawl and "other") each year.

2) NMFS must advance population estimates beyond a nestin index by including in-water monitoring of sea turtles to achieve more accurate status assessments for these species and to better assess the impacts of incidental take in fisheries. NMFS must produce an in-water abundance report using the best available data for all species of sea turtles in the Southeast region of the United States within three years of the date of this opinion.

3) NMFS must investigate alternatives to observers that can be used to detect sea turtle interactions.

4) NMFS must explore requiring new technologies in Southeast shrimp fisheries to better understand potential interaction of shrimp effort and stranding events. NMFS must produce a report outlining potential options and their feasibility within two years of the date of this opinion.

5) NMFS must conduct an analysis of sea turtle stranding data to document whether the size of sea turtles stranding has changed since implementation of the 2003 larger TED requirement. This analysis will be initiated upon the completion of term and condition No. 11 and will be completed within three years of the date of this opinion.

The following terms and conditions implement RPM No. 2.

6) NMFS must require its observers to be trained during initial or refresher observer training sessions by NMFS gear specialists in identifying and inspecting TEDs and to record such information for any trip observed.

7) NMFS must continue to monitor compliance with TED regulations using a combination of three elements.

a) The SEFSC GMT must continually monitor shrimp fishing vessels dock side and at sea throughout the Gulf and South Atlantic areas. The SEFSC GMT personnel must record all non compliance issues during monitoring efforts in sufficient detail for analyzing its impact on the effectiveness of TEDs in releasing sea turtles.
b) NMFS enforcement must continue to enforce TED regulations and must keep records of all compliance boardings in sufficient detail for analyzing its impact on the effectiveness of TEDs in releasing sea turtles.
c) NMFS must work with state enforcement agencies and the USCG to improve and standardize enforcement of TED regulations.

8) NMFS SERO PRD must coordinate with the SEFSC GMT, the SEFSC observer program, NMFS OLE, USCG and state enforcement agencies to gather information on compliance with TED regulations in the shrimp fisheries. The gear compliance data will be made available to SERO for 6 month analyses and analyzed in the same manner as the compliance data used in this opinion to develop estimates of average capture rates.

9) If capture rates based on compliance data are above 12% (the anticipated level in the Proposed Action section and ITS of this opinion) for any six month time period, NMFS must use a step wise approach to deal with low levels of TED compliance. NMFS must use the data on TED compliance to target outreach, enforcement effort, and emergency rules ranging from possible TED modifications to closures of areas to shrimp fishing.

a) NMFS must determine if the lack of compliance is throughout the entire area (Gulf area or Atlantic area) or concentrated in certain portions of an area.
b) Once the extent and area/areas of non-compliance are determined, NMFS, through the SEFSC GMT, must hold trainings, conduct courtesy boardings, and other outreach as necessary in the area/areas where non compliance with TED regulations is prevalent. NMFS OLE must consider what enforcement response is most appropriate to address non-compliance.
c) NMFS must increase the frequency of compliance data analysis (term and condition 8) to a monthly basis to determine if its actions under term and condition 9b are having the desired effect.
d) If after six months capture rates based on compliance data continue to be above 12 %, NMFS must consider using its authority under section 11(f) of the ESA to close the area/areas of non compliance to shrimp fishing for up to one year. NMFS can choose to lessen this time if it can demonstrate that continued outreach will improve compliance in the area such that the capture rate will be at acceptable levels within less than one year.

10) If unusual increases in strandings occur in an area, NMFS must analyze this information and take appropriate action.

a) NMFS must have as many of the stranded animals necropsied as possible; at the same time the SEFSC GMT and NMFS enforcement must coordinate to investigate shrimp fishing activities and any other activities that may have resulted in the increased standings.

b) If shrimp fishing is believed to be the most likely cause then NMFS must concentrate enforcement in the fishing area believed to be the problem and must work with affected states and the USCG to increase the enforcement presence in that area.
c) If strandings continue at elevated levels and shrimping continues to be the most likely cause, then NMFS must consider emergency rule making to temporarily close the area to shrimp fishing until strandings subside.

The following terms and conditions implement RPM No. 3

11) NMFS must work to revise its stranding agreement and data use policy with the States to improve STSSN data and researcher's access and ability to use the data. The existing agreement specifies that the data can be used for management purposes; however, data under the existing agreement cannot be presented or published without written consent from all contributing state stranding network coordinator(s). The NRC (2010) recommended the STSSN should make information on all stranded sea turtles available for evaluation at least by review teams and assessment modelers.

12) NMFS, in coordination with USFWS, should conduct or arrange for a review of the STSSN to evaluate consistency in data collection and to identify areas that have low or inconsistent sampling effort.

The following terms and conditions implements RPM No. 4.

13) NMFS must continue to work with industry to develop new gear, especially TEDs that will be effective at releasing all sizes and all species of sea turtles while still retaining catch.

    a) NMFS must continue to fund gear research and annual gear testing conducted by the NMFS SEFSC's Harvesting Systems Branch.

    b) NMFS SERO PRD must continue to issue permits to industry to test industry-developed TEDs under 50 CFR § 223.207(e)(2).

14) NMFS must continue training Southeast fishermen and net shop owners on the proper installation and use of TEDs. This will be especially important during the implementation of the new sea turtle conservation regulations that are part of this proposed action. This can be completed by funding the SEFSC GMT or by other means determined appropriate (grants, etc).

15) The SEFSC GMT must report to SERO monthly on its TED training and outreach activities.

16) NMFS must form a working group including SEFSC GMT, OLE, and SERO staff to develop procedural guidelines for and improve coordination during unusual sea turtle stranding and enforcement events and improve data and reporting quality.

The following terms and conditions implements RPM No. 5.

17) Within in six months of the date of this opinion, NMFS must have a plan to increase the observer effort for the shrimp trawl fishery in south and southwest Florida where sawfish interactions are most likely to occur using standard observer protocols and/or using electronic monitoring, while still maintaining other program needs (i.e., stock assessment and sawfish data needs).

    a) Observers must be trained to tag smalltooth sawfish captured in shrimp trawls and tag smalltooth sawfish captured in shrimp trawls whenever feasible.
    b) For each observed sawfish take, a total length measurement or estimate, time and location (i.e., lat./long. and approximate water depth) of capture, circumstances of capture (e.g., position of sawfish in the trawl net), and status (i.e., dead, alive, injured) upon return to the water must be reported to the extent possible. Biological samples should also be collected as feasible consistent with sampling protocols developed by the Sawfish Implementation Team.
    c) All dead carcasses of smalltooth sawfish must be placed on ice and transferred to the SEFSC (Dr. John Carlson).
    d) The SEFSC must use available observer data and any other appropriate data sources to update the 3-year take average as new data becomes available.

18) Within one year of the date of this opinion NMFS must have a research plan to determine post-release mortality rates for smalltooth sawfish in the shrimp fishery. Implementation of this plan must be initiated within two years of the date of this opinion.

19) NMFS must conduct outreach on the NSED, the importance of reporting any sawfish sighting or interactions to NSED, and how to report information.

The following term and condition implements RPM No. 6.

20) NMFS must develop outreach materials that include the safe handling guidelines for sawfish release, these materials must include at a minimum the following:

    a) Keep sawfish, especially the gills in the water as much as possible.
    b) Use line cutting pole or knife to cut any net tangled along the saw by cutting the mesh along the length of the saw.

The following terms and conditions implements RPM No. 7.

21) Within six months of the date of this opinion, NMFS must have a plan to increase the observer effort for the shrimp trawl fisheries in NC, SC, and GA, where Atlantic sturgeon interactions are most likely to occur, using standard observer protocols and/or using electronic monitoring, while still maintaining other program needs (i.e., stock assessment and sawfish data needs). Within 18 months of the date of this opinion, NMFS must use the observer data to produce an Atlantic sturgeon bycatch estimate; this estimate must be updated annually.

a) Observers must be trained during initial or refresher training sessions in tagging techniques for Atlantic sturgeon. When possible, any Atlantic sturgeon caught in shrimp trawl must be tagged, tissue sampled, and scanned for PIT tags.
b) When possible, for each observed Atlantic sturgeon take, a total length measurement or estimate, weight measurement or estimate, sex (if discernible), time and location (i.e., lat./long. and approximate water depth) of capture, whether or not had or was tagged and if so what type of tag was used, and status (i.e., dead, alive, injured) should be recorded prior to its release.
c) A tissue sample shall be taken from any sturgeon handled onboard a shrimp boat. Tissue samples should be a small (1.0 cm^2) fin clip collected from soft pelvic fin tissue using a pair of sharp scissors. Tissue samples should be preserved in individually labeled vials containing either alcohol (70 to 100%) or SDS-UREA or other preservative. Data required in 17(b) should accompany the tissue sample. Keep the tissue sample out of direct sun, but refrigeration is not necessary. Contact Kelly Shotts (Kelly.Shotts@noaa.gov or (727) 551-5603) for instructions on submitting the tissue samples to NMFS. Send samples and supporting data within one month of the date the sample is taken.

22) Within in one year of the date of this opinion, NMFS must have a research plan to determine post-release mortality rates for Atlantic sturgeon in shrimp trawls. This plan must be implemented within two years of the date of this opinion.

23) All dead observed Atlantic sturgeon must be reported to Kelly Shotts (Kelly.Shotts@noaa.gov or (727) 551-5603). After activities described in #17 are complete, the remaining specimen(s) or body parts of dead Atlantic sturgeon must be preserved (iced or refrigerated) until sampling and disposal procedures are discussed with NMFS.

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 otter trawls.

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

3. NMFS should conduct or fund surveys or other alternative methods for determining smalltooth sawfish abundance in federal 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).

4. NMFS should investigate whether exclusion from trawls may be improved by lining or replacing the section of the net ahead of the TED with a difference material (e.g., canvas, fine metal mesh, or tough flexible plastic) as suggested by Brewer et al. (2006).

Sturgeon:

1. NMFS should collect data describing Atlantic and Gulf sturgeon location and movement in the Atlantic and Gulf of Mexico, respectively, by depth and substrate to assist in future

assessments of interactions between the shrimp trawl fishery and sturgeon migratory and feeding behavior.

2. NMFS should collect information on incidental catch rates and condition of sturgeon captured in shrimp trawls to assist in future assessments of gear impacts to sturgeon.

3. NMFS should continue to collect information on rates of sturgeon escape from shrimp trawl gear through TEDS that would assist in future assessments of sturgeon interactions with gear.

11.0 Reinitiation of Consultation

This concludes formal consultation on the proposed action. 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: Development of TEDs

Trawling is a method of fishing that involves actively pushing or towing a net through the water. Trawls can be unselective and have the capability to incidentally capture sea turtles and other species that are not the intended target of the fishery. Sea turtles captured in commercial trawl fisheries may drown due to forced submergence over long periods. Even when drowning does not occur, the stress of forced submergence has been shown to result in various negative physiological consequences (Henwood and Stuntz 1987; Lutcavage and Lutz 1997) that can make the turtles susceptible to delayed mortality, predation, boat strike or other sources of injury and mortality.

NMFS began developing physical barriers in trawl nets to deflect sea turtles from trawl codends in the 1970s. Briefly, according to Watson et al. (1986), soft panel separator gear for trawls, designed originally for cold-water shrimp fisheries in the 1960s, were the first turtle excluder gear evaluated for the shrimp fishery. Testing and development in commercial fishing conditions in the Gulf of Mexico indicated a rigid grid was needed due to the diversity in the sizes and types of fish bycatch that clogged or ripped soft panels (Watson and McVea 1977). Oravetz and Grant (1986) describe the adaptation of the "jellyball" shooter, a hooped grid with a slit at the top inserted by Georgia shrimp fishermen ahead of the codend of the trawl to exclude jellyfish. By 1980, a rigid grid TED was developed and shown to be effective at eliminating sea turtles, as well as finfish, jellyfish, sharks, rays, sponge and other large bycatch (Watson et al. 1986).

Turtle Excluder Device Regulation History

1970: Hawksbill, Kemp's ridley, and leatherback sea turtles are listed by the U.S. Fish and Wildlife Service (USFWS) as endangered species under the Endangered Species Conservation Act of 1969.

December 28, 1973: Enactment of the Endangered Species Act of 1973 (ESA).

May 20, 1975: NMFS and USFWS publish a proposal to list green, loggerhead, and (Pacific) olive ridley sea turtles as threatened species under the ESA (40 FR 21982, 40 FR 21974). The proposal includes an exception to the ESA takings prohibitions for incidental catch of threatened sea turtles in fishing gear if: (a) the fishing is not in an area of substantial sea turtle breeding or feeding, and (b) the turtles are immediately returned to the water.

July 28, 1978: NMFS and USFWS publish final regulations (43 FR 32800) listing loggerhead, green, and olive ridley sea turtles as threatened species, except for Florida green turtle breeding colony populations and Pacific coast of Mexico olive ridley and green turtle breeding colony populations, which were listed as endangered. Many commenters on the proposal had objected to the "areas of substantial breeding and feeding" language, fearing that a strict interpretation could put many shrimpers out of business. In the final rule, incidental capture of threatened turtles with fishing gear is exempted from the ESA takings prohibitions in all areas, if turtles are returned to the water following resuscitation attempts for unconscious animals. The rule also states that NMFS has developed and is testing a turtle excluder panel installed across the mouth of a shrimp trawl to prevent or substantially reduce the capture of sea turtles, with the objective of completing the development and testing of the panel by the end of the 1978 shrimp season. NMFS states its "goal is to promulgate regulations requiring the use of the panel to prevent, or substantially reduce, incidental catch of sea turtles without significantly reducing shrimp production."

1978: Testing of the turtle excluder panels resulted in preventing 75 percent of encountered turtles from entering the trawls, but shrimp losses (15 to 30 percent) were unacceptable. Research was then directed towards releasing turtles once they entered the trawl versus preventing them from entering the trawl (NMFS 1987).

1978-1981: NMFS attention is turned toward testing and development of a rigid turtle excluder device (TED) that can be inserted farther back in the net. Turtle exclusion and shrimp retention results for the TED are positive. By 1981, the NMFS TED – a large, cage-like device with a metal-framed trap door – has been developed and found to release 97 percent of the turtles caught in shrimp trawls with no loss of shrimp (52 FR 24244, June 29, 1987).

1981-1983: NMFS encourages voluntary use of TEDs in the shrimp fishery.

1983-1986: NMFS operates a formal program which builds and delivers TEDs to shrimp fishermen who agree to use them voluntarily in commercial shrimping operations. The program proves ineffective. As of late 1986, less than three percent of the shrimp fleet had used TEDs (Oravetz 1986).

October-December 1986: NMFS sponsors mediated sessions involving environmental and shrimp industry groups. The negotiations attempt to develop a mutually acceptable implementation of TED requirements and avert threatened litigation from environmental groups. One party to the mediation sessions, the Concerned Shrimpers of Louisiana, refuses to sign the developed agreement and negotiations break down.

1987: A report (Henwood and Stuntz 1987) analyzing observer data from the southeast U.S. shrimp fishery from 1973-1984 conservatively estimates that the shrimp fishery in offshore waters kills 9,874 loggerhead, 767 Kemp's ridley, and 229 green turtles annually.

March 2, 1987: NMFS develops and publishes proposed regulations to require the use of TEDs in most offshore shrimp trawlers (52 FR 6179).

June 29, 1987: NMFS publishes final regulations implementing TED requirements (52 FR 24244). The regulations are codified at 50 CFR parts 217, 222, and 217. Many of the provisions of the rule phase in over a 20-month period. Ultimately, TEDs are required seasonally aboard all shrimp trawlers over 25 feet in length in offshore waters of the Gulf and South Atlantic, except for southwest Florida and the Canaveral area, where they are required year-round. Shrimp trawlers less than 25 feet in length and all trawlers in inshore waters are required to limit their tow-times to a maximum of 90 minutes seasonally, except in southwest Florida and the Canaveral area, where tow-times are required year-round. Exemptions to the TED requirement are included for trawlers fishing for royal red shrimp and rock shrimp. Try nets up to 20 feet in headrope length are also exempted. Four specific designs of hard TEDs – the NMFS TED, the Cameron TED, the Matagorda TED, and the Georgia TED – are included in the regulations as qualified TEDs. The minimum size of the TED escape openings is specified as 32 inches in the Gulf and 35 inches in the Atlantic, but how this opening is measured is not specified. The regulations make provisions for testing and approving additional TED designs that may be developed by NMFS or the shrimping industry. An appendix published with the regulations specifies a scientific protocol for evaluating new TEDs in the Cape Canaveral shipping channel. Candidate TEDs must demonstrate a reduction in the catch of wild turtles, compared to a net with no TED, of greater than 96 percent.

September 30, 1987: NMFS completes a biological opinion on the implementation of the 1987 regulations. The 1987 opinion addresses the potential adverse effects to listed species of implementation of the rule, and concludes that the regulations would have a positive impact on sea turtles by substantially reducing mortalities. At that time, NMFS' policy on ESA section 7 consultation is to address the potential impacts to listed species of management actions and not to address potential adverse effects of the fishery itself. The policy is ultimately changed on October 18, 1990, when the Assistant Administrator for Fisheries advises all NMFS Regional Directors that future ESA consultations on fishery management actions would address both the fishery and the proposed management action.

October 5, 1987: NMFS issues a final rule/technical amendment (52 FR 37152) to authorize an additional type of TED, the Morrison TED, which is the first soft TED. It uses an upward-sloping panel of flexible webbing instead of the rigid grid used in hard TEDs.

October 1987 - May 1990: A chaotic array of lawsuits, injunctions, suspensions of law enforcement, legislative actions by several states, legislation by Congress, and temporary rules issued by NMFS and the Department of Commerce follows the initial effective date of the 1987 regulations. The result is a patchwork of times and areas where TEDs are and are not required/enforced.

October 7, 1988: President Reagan signs a bill that requires a study by the National Academy of Sciences to review the question of sea turtle conservation status and the significance of mortality from commercial trawling.

September 1, 1988: NMFS issues a final rule/technical amendment (53 FR 33820) to authorize an additional soft TED, the Parrish TED. It uses a downward-sloping webbing panel leading to a rigid frame.

November 21, 1989: President G. Bush signs Public Law 101-162. Section 609 requires the Department of State, in consultation with the Department of Commerce, to initiate negotiations with foreign countries to develop agreements for sea turtle conservation, with emphasis on countries that have commercial fishing fleets that adversely affect sea turtles. It further requires the United States to ban the importation of commercially harvested shrimp unless the exporting country has been certified by the Department of State as having a regulatory program for sea turtle incidental capture in shrimp trawls that is comparable to the United States' requirements. The certification is due on May 1, 1991, and annually thereafter.

May 1990: The report, “Decline of the Sea Turtles: Causes and Prevention,” is released (National Research Council 1990). The report concludes that: (1) combined annual counts of nests and nesting females indicate that nesting sea turtles continue to experience population declines in most of the United States. Declines of Kemp’s ridleys on the nesting beach in Mexico and of loggerheads on South Carolina and Georgia nesting beaches are especially clear; (2) natural mortality factors – such as predation, parasitism, diseases and environmental changes – are largely unquantified, so their respective impacts on sea turtle populations remain unclear; (3) sea turtles can be killed by several human activities, including the effects of beach manipulations on eggs and hatchlings and several phenomena that affect juveniles and adults at sea, collisions with boats, entrapment in fishing nets and other gear, dredging, oil-rig removal, power plant entrainment, ingestion of plastics and toxic substances, and incidental capture in shrimp trawls; (4) shrimp trawling kills more sea turtles than all other human activities combined, and the annual mortality estimate from Henwood and Stuntz (1987) may be low by as much as a factor of four; (5) shrimp trawling can be compatible with the conservation of sea turtles if adequate controls are placed on trawling activities, especially the mandatory use of TEDs in most places at most times of the year; and (6) the increased use of conservation measures on a worldwide basis would help to conserve sea turtles.

October 9, 1990: NMFS issues a final rule/technical amendment (55 FR 41088) to authorize an additional soft TED, the Andrews TED. It uses a net-within-the-net design.

October 9, 1990: NMFS publishes an alternative scientific protocol (55 FR 41092) to the Canaveral test for approving new TED designs. In 1989, there were not enough turtles in the Canaveral Channel to conduct TED testing, necessitating the development of a new protocol. The new small turtle test protocol overcomes some of the other concerns over the Canaveral test. In particular, it uses turtles that are similar in size to wild Kemp’s ridleys, the species of greatest conservation concern at the time, and it allows divers to videotape every turtle’s encounter with the candidate TED, greatly increasing the understanding of the factors in a TED’s design that affect sea turtle exclusion. The small turtle test’s limitation, however, is that, since captive animals are used under experimental conditions, the metric used for decisions is a candidate TED’s performance relative to a control TED, rather than its straight reduction in sea turtle captures.

April 1992: The South Atlantic Fishery Management Council (SAFMC) requests consultation on the Shrimp Fishery Management Plan for the South Atlantic, and the Gulf of Mexico Fishery Management Council (GMFMC) requests consultation on Amendment 6 to the Gulf of Mexico Shrimp Fishery Management Plan.

April 30, 1992: NMFS proposes to amend the sea turtle conservation regulations to strengthen their effectiveness and enforceability (57 FR 18446). The proposal would require essentially all shrimp trawlers in the southeast U.S. to use TEDs year-round, even in inshore waters, with only limited exemptions.

August 19, 1992: NMFS completes section 7 consultation and issues a biological opinion that considers the two Council’s FMPs, the shrimp fishery itself in the Gulf and South Atlantic, and the implementation of the 1992 revised sea turtle conservation regulations. The opinion concludes that shrimp trawling, as managed by the Councils and in compliance with the proposed sea turtle conservation regulations, is not likely to jeopardize the continued existence of listed species under NMFS' jurisdiction. With respect to leatherback turtles, however, the opinion states, "leatherback mortalities remain a problem that must be addressed to avoid jeopardizing the recovery of this species." The opinion's incidental take statement includes six reasonable and prudent measures (RPMs). Three have to do with items that are implemented through the regulations (required use of TEDs, limitations on the use of tow-times, and resuscitation of comatose turtles). A fourth is the requirement to implement an observer program to monitor turtle take whenever tow-times are authorized as an alternative to TEDs. NMFS never implements such an observer program. Instead, on the future occasions when NMFS does subsequently issue tow-time authorizations because of hurricane debris or algae blooms, NMFS consults with the state fisheries directors who agree to provide elevated enforcement to ensure compliance with tow-times. A fifth reasonable and prudent measure states that NMFS should develop a program so that all turtle mortalities are reported to the Southeast Regional Office of NMFS in person, by phone, or by letter, within 10 days of return from the fishing trip during which the incidental take occurred. This reporting program is never implemented. The final requirement is to develop and implement a contingency plan to eliminate the episodic take of leatherback turtles by shrimp trawlers. A contingency plan addressing some months along the Atlantic coast is ultimately developed.

September 8, 1992: NMFS publishes an interim final rule implementing some of the provisions of the April 1992 proposed rule.

December 4, 1992: NMFS publishes a final rule (57 FR 57348) implementing the April proposal. The rule includes a phase-in period for inshore vessels with small nets until December 1, 1994. The rule requires all shrimp trawlers in inshore and offshore waters from North Carolina to Texas to have TEDs installed in all nets that are rigged for fishing. Exempted from the TED requirements are: (1) royal red shrimp trawlers; (2) beam and roller trawls, if vertical bars on 4-inch spacings are attached across the mouth of the trawl; and (3) a single try net, up to 20 feet in headrope length, per boat. Also exempted from the TED requirements, if fishermen follow tow-time limits of 55 minutes from April-October and 75 minutes from November-March, are: (1) trawls that are entirely hand-hauled; (2) bait shrimpers, if all shrimp are kept in a live-well with no more than 32 pounds of dead shrimp aboard; (3) pusher-head trawls (i.e., chopsticks rigs), skimmer trawls, and wing nets (i.e., butterfly nets); (4) trawlers in an area and at a time where the Assistant Administrator determines that special environmental conditions make TED use impracticable; and (5) if the Assistant Administrator determines that TEDs are ineffective. Resuscitation measures that fishermen must follow for incidentally caught turtles that come aboard in a comatose condition are modified, and fishermen are allowed to hold turtles on board under certain conditions, while they are being resuscitated. The technical specifications for hard TEDs are rewritten to create more explicit and more flexible descriptions of the required construction characteristics of hard TEDs, rather than require shrimpers to use one of the four named styles of hard TEDs from the 1987 regulation. The specifications for the TED opening dimensions are clarified for single-grid hard TEDs: 35 inches horizontal and, simultaneously, 12 inches vertical in the Atlantic, and 32 inches horizontal and, simultaneously, 10 inches vertical in the Gulf of Mexico. Descriptions of accelerator funnels and webbing flaps – optional modifications to increase shrimp retention – are added. A framework and procedures are established whereby the Assistant Administrator may impose additional restrictions on shrimping, or any other fishing activity, if the incidental taking of sea turtles in the fishery would violate an incidental take statement, biological opinion, or incidental take permit or may be likely to jeopardize the continued existence of a listed species.

May 17, 1993: NMFS issues a final rule/technical amendment (58 FR 28795) to authorize an additional soft TED, the Taylor TED. It is similar to the Morrison TED, but uses a smaller panel of smaller-mesh webbing and a flap over the escape opening. A modification of the Morrison TED to use a larger escape opening covered with a flap is also approved. The Taylor TED and modified Morrison TED have escape openings that are large enough to release leatherback turtles.

October 20, 1993: NMFS issues a final rule/technical amendment (58 FR 54066) to create a new category of hard TEDs – special hard TEDs – and to authorize a new special hard TED for the shrimp fishery, the Jones TED. The Jones TED features bars that are set diagonally, rather than vertically, in the face of the grid, and whose bar ends are not attached to other bars or to the TED frame.

May 18, 1994: NMFS issues a final rule/technical amendment (59 FR 25827) to specify a modification that can be made to the escape opening of single grid hard TEDs that will allow the TEDs to exclude leatherback turtles.

June 29, 1994: NMFS issues an interim final rule (59 FR 33447) to require bottom-opening hard TEDs to be modified by attaching floats to the TEDs to keep them from riding hard on the sea floor. Major increases in sea turtle strandings were observed in early 1994 in Texas, and the absence of floats on bottom-opening TEDs was determined to be one contributing factor.

November 14, 1994: NMFS completes section 7 consultation and issues a biological opinion on the impacts of shrimp trawling in the southeastern United States (NMFS 1994). Consultation on the shrimp fishery had been reinitiated as the result of extraordinarily high strandings of sea turtles, particularly the critically endangered Kemp's ridley turtle, in Texas and Louisiana corresponding to periods of heavy nearshore shrimping effort. The opinion concludes that "continued long-term operation of the shrimp fishery in the southeastern U.S., resulting in mortalities of Kemp's ridley turtles at levels observed in the Gulf of Mexico in 1994, is likely to jeopardize the continued existence of the Kemp's ridley population." The jeopardy opinion included a reasonable and prudent alternative (RPA) that would allow the shrimp fishery to continue and avoid the likelihood of jeopardizing Kemp's ridley sea turtles. The RPA specified the following measures that NMFS must take to improve TED regulation compliance: (1) develop an emergency response plan (ERP) to address increases in sea turtle strandings or TEDs noncompliance; (2) deploy a specially trained law enforcement team to respond to high strandings, TEDs noncompliance, or intensive shrimping effort in areas of expected sea turtle abundance; (3) develop and implement a TED enforcement training program for U.S. Coast Guard boarding parties; (4) amplify domestic TED technology programs; and (5) develop a permitting or registration system for offshore shrimpers that would allow sanctioning the permit for TED violations and failing to pay assessed fines. NMFS also was required to re-examine the effectiveness of bottom-shooting hard TEDs and soft TEDs, and mitigate the impacts of intensive nearshore shrimping effort through the identification of areas requiring special turtle management. NMFS ultimately implemented all the elements of the RPA, with the exception of the shrimp fishery permitting/registration system. The opinion's incidental take statement, in addition to establishing incidental take levels based on observer coverage, sets indicated take levels, based on historical stranding levels. The ITS incorporates all of the RPMs from the 1992 opinion and also adds a number of new RPMs, such as improving the overall observer coverage in the shrimp fishery and stranding network coverage in poorly covered states. NMFS must use this observer and stranding information to implement the actions of the ERP. NMFS must also convene a team of population biologists, sea turtle scientists, and life history specialists to compile and examine information on the status of sea turtle species. The team should attempt to determine the maximum number of individual sea turtles of each species that can be taken incidentally to commercial fishing activities without jeopardizing the continued existence of the species and what the corresponding level of strandings would be. Lastly, NMFS is required to evaluate other human-caused sources of sea turtle mortality and identify measure to reduce those sources of mortality.

March 14, 1995: NMFS issues the details of the ERP, required under the RPA of the 1994 opinion. The ERP is issued to identify monitoring, reporting and enforcement actions, as well as associated management measures that NMFS would consider implementing by emergency rulemaking if strandings become elevated. Briefly, the ERP identifies interim sea turtle management areas (ISMAs) within which enforcement would be elevated from April through November. Two ISMAs were identified: Atlantic Interim Special Management Area, including shrimp fishery statistical Zones 30 and 31 (i.e., northeast Florida and Georgia) and the Northern Gulf Interim Special Management Area, including statistical Zones 13 through 20 (i.e., Louisiana and Texas from the Mississippi River to North Padre Island). NMFS would implement gear restrictions on shrimp trawling through existing rulemaking authority (codified at 50 CFR 227.72(e)(6)) in response to two weeks of elevated strandings at levels approaching (within 75 percent of) the indicated take levels or higher in the ISMAs when no other likely causes of mortality were evident. Outside of the ISMA, implementation of similar restrictions would be considered after four weeks of elevated strandings. Areas monitored were delineated as the NMFS shrimp fishery statistical areas, and restrictions would be implemented within zones of elevated strandings out to 10 nautical miles (nm) offshore.

March 24, 1995: NMFS issues a final rule/technical amendment (60 FR 15512) to finalize the float requirement and implement a variety of other minor changes to TED technical specifications. One of these specifies that the width of the cut for a hard TED's escape opening must extend at least from the outermost bar of the grid to the opposite outermost bar of the grid.

May-August 1995: NMFS implements gear restrictions based on the ERP through temporary rulemaking four times during 1995: twice in the Gulf of Mexico and twice in the Atlantic (60 FR 21741, May 3, 1995; 60 FR 26691, May 18, 1995; 60 FR 31696, June 16, 1995; 60 FR 32121, June 20, 1995; 60 FR 42809, August 17, 1995; 60 FR 43106, August 18, 1995; 60 FR 44780, August 29, 1995).

May 12, 1995: NMFS issues an interim rule (60 FR 25620) to establish all inshore and offshore waters from Cape Canaveral, Florida (28° 24.6'N) to the North Carolina-Virginia border (36° 30.5'N) as the leatherback conservation zone and to provide for short-term closures of areas in that zone when high abundance levels of leatherback turtles are documented (i.e., "the leatherback contingency plan"). Upon such documentation, NMFS would prohibit, in the closed areas, fishing by any shrimp trawler required to have a TED installed in each net that is rigged for fishing, unless the TED installed is specified in the regulations as having an escape opening large enough to exclude leatherback turtles. NMFS also proposes (60 FR 25663) to adopt as final this interim rule establishing the leatherback conservation zone.

June 2, 1995: NMFS temporarily amends the regulations (60 FR 28741) protecting sea turtles to allow compliance with tow-time limits as an alternative to the use of TEDs in a 30-square mile (48.3-square km) area off the coast of North Carolina to allow shrimp fishermen to fish under conditions of high concentrations of red and brown algae that make trawling with TEDs impracticable while maintaining adequate protection for sea turtles in this area.

September 14, 1995: NMFS issues a final rule (60 FR 47713) establishing the leatherback conservation zone and leatherback contingency plan in the Atlantic.

April 24, 1996: NMFS proposes (61 FR 18102) prohibiting the use of all previously approved soft TEDs; requiring the use of approved hard TEDs in try nets with a headrope length greater than 12 feet (3.6 m) or a footrope length greater than 15 feet (4.6 m); establishing Shrimp Fishery Sea Turtle Conservation Areas (SFSTCAs) in the northwestern Gulf of Mexico and in the Atlantic along the coasts of Georgia and South Carolina; and, within the SFSTCAs, prohibiting soft TEDs, imposing the new try net restrictions, and prohibiting the use of bottom-opening hard TEDs.

June 11, 1996: NMFS completes section 7 consultation and issues a biological opinion on the impacts of shrimp trawling in the southeastern United States (NMFS 1996). Consultation on the shrimp fishery had been reinitiated to evaluate the effects of the April 24, 1996 proposed rule, a plan to implement a shrimp vessel registration system, and to consider the effects of strandings-based incidental take levels that had been exceeded. The opinion concludes that continued operation of the shrimp fishery is not likely to jeopardize listed sea turtles, with implementation of the proposed TED rule changes and of a shrimp vessel registration system, which the opinion requires to be proposed formally by the end of 1996. The opinion also eliminates the strandings-based incidental take levels that had been in place since the introduction of the ERP in March 1995. The ERP is replaced instead with a more flexible requirement for NMFS to consult with state stranding coordinators to identify significantly local stranding event and to implement 30-day restrictions on shrimping in response, as appropriate.

June 27, 1996: NMFS issues temporary additional restrictions (61 FR 33377) on shrimp trawlers fishing in the Atlantic Area in inshore waters and offshore waters out to 10 nautical miles (18.5 km) from the COLREGS line between the Georgia-Florida border and the Georgia-South Carolina border. The restrictions include prohibitions on the use of soft TEDs and try nets with a headrope length greater than 12 feet (3.6 m) or a footrope length greater than 15 feet (4.5 m), unless the try nets are equipped with approved TEDs other than soft TEDs. The restrictions are in response to elevated sea turtle mortality.

November 13, 1996: NMFS completes section 7 consultation and issues a biological opinion on the impacts of shrimp trawling in the southeastern United States (NMFS 1996). Consultation on the shrimp fishery had been reinitiated to evaluate the effects of the final rule implementing the April 24, 1996 proposed rule and of elevated loggerhead strandings that occurred during 1996. The opinion concludes that continued operation of the shrimp fishery is not likely to jeopardize listed sea turtles, with the publication of the final rule, which implements the RPA component of the 1994 opinion requiring NMFS to address mortalities resulting from incorrect installation of TEDs and the certification of TEDs which do not effectively exclude sea turtles. The opinion extends the deadline for finalizing the shrimp vessel registration requirement through February 1997.

December 19, 1996: NMFS issues a final rule (61 FR 66933) requiring that TEDs be installed in try nets with a headrope length greater than 12 feet (3.6 m) and a footrope length greater than 15 feet (4.6 m); removing the approval of the Morrison, Parrish, Andrews, and Taylor soft TEDs; establishing SFSTCAs, and within the SFSTCAs, imposing the new TED requirement for try nets, removing the approval of soft TEDs, and modifying the requirements for bottom-opening hard TEDs.

March 24, 1998: NMFS completes section 7 consultation and issues a biological opinion on the impacts of shrimp trawling in the southeastern United States (NMFS 1998). Consultation on the shrimp fishery had been reinitiated to evaluate the effects of approving the use of a new soft TED, to discuss the decision not to implement a mandatory shrimp vessel registration system (part of the 1994 biological opinion's RPA), and to evaluate recent data on sea turtle populations and strandings. The opinion concludes that continued operation of the shrimp fishery is not likely to jeopardize listed sea turtles, with continued improved enforcement of the sea turtle conservation regulations and expanded education and outreach programs.

April 13, 1998: NMFS issues an interim final rule (63 FR 17948) authorizing the use of a new soft TED – the Parker TED – in certain trawl net styles for an 18-month trial period, during which its performance will be evaluated to ensure that it remains effective at excluding sea turtles during extended commercial use.

October 14, 1998: NMFS issues a temporary rule (63 FR 55053) effective through November 6, 1998, to allow the temporary use of limited tow times by shrimp trawlers in Alabama inshore waters as an alternative to the requirement to use TEDs in order to address difficulty with TED performance due to large amounts of debris in Alabama's bays in the aftermath of a hurricane.

May-June 1999: NMFS issues four temporary rules (64 FR 25460, May 12, 1999; 64 FR 27206, May 19, 1999; 64 FR 28761, May 27, 1999; 64 FR 29805, June 3, 1999) to protect leatherback sea turtles within the leatherback conservation zone.

October 13, 1999: NMFS issues an interim final rule (64 FR 55434) extending the authorized use of the Parker TED for an additional 12 months, as the results of the Parker TED's evaluation have been inconclusive.

December 13, 1999: NMFS issues a 30-day rule (64 FR 69416) imposing an additional restriction on shrimp trawlers required to have a TED installed in each net that is rigged for fishing, operating in Atlantic offshore waters out to 10 nautical miles from the coast of Florida between 28°N latitude and the Georgia-Florida border. Shrimp vessels operating in this area must use the leatherback modification for hard TEDs or the leatherback modification for the Parker soft TED. The restrictions are in response to greatly elevated leatherback sea turtle strandings in the area. The strandings occur during a time when the leatherback contingency plan does not apply, necessitating the use of the 30-day rule.

October 25, 1999: NMFS issues a temporary rule (64 FR 57397) to allow the use of limited tow times by shrimp trawlers as an alternative to the use of TEDs in the Matagorda Bay area of Texas. This action is required due to extraordinarily high concentrations of a bryozoan lodging in TEDs, rendering them ineffective in expelling sea turtles as well as negatively impacting fishermen's catches.

April 5, 2000: NMFS issues an advance notice of proposed rulemaking to announce that it is considering technical changes to the requirements for TEDs. NMFS proposes to modify the size of the TED escape opening, modify or decertify hooped hard TEDs and weedless TEDs, and change the requirements for the types of flotation devices allowed. NMFS also proposes to consider modifications to the leatherback conservation zone regulations to provide better protection to leatherback turtles.

April 25, 2000: NMFS issues a 30-day rule (65 FR 24132) imposing an additional restriction on shrimp trawlers required to have a TED installed in each net that is rigged for fishing, operating in Gulf of Mexico offshore waters out to 10 nautical miles between Port Mansfield Channel and Aransas Pass, Texas. Shrimp vessels operating in this area must use the leatherback modification for hard TEDs or the leatherback modification for the Parker soft TED. The restrictions are in response to leatherback sea turtle strandings in the area. The strandings occur in an area where the leatherback contingency plan does not apply, necessitating the use of the 30-day rule.

May 2000: NMFS issues two temporary rules (65 FR 25670, May 3, 2000; 65 FR 33779, May 25, 2000) to protect leatherback sea turtles within the leatherback conservation zone.

August 29, 2000: NMFS issues a temporary rule (65 FR 52348) to allow the use of limited tow times by shrimp trawlers as an alternative to the use of TEDs in inshore waters of Galveston Bay, Texas. Dense concentrations of marine organisms documented in this area were clogging TEDs, rendering them ineffective in expelling sea turtles from shrimp nests as well as negatively impacting fishermen's catches.

January 9, 2001: NMFS issues a final rule (66 FR 1601) permanently approving the use of the Parker soft TED. Although industry use of the Parker TED is extremely low, NMFS' evaluation of its effectiveness does not find significant problems with compliance with the TED's specifications or with sea turtle captures.

May 14, 2001: NMFS issues an interim final rule (66 FR 24287) approving the use of an additional style of single-grid hard TED – the double cover flap TED.

October 2, 2001: NMFS issues a proposed rule (66 FR 50148) to amend the sea turtle conservation regulations to enhance their effectiveness in reducing sea turtle mortality resulting from shrimp trawling in the Atlantic and Gulf Areas of the southeastern United States. NMFS determines that modifications to the design of TEDs need to be made to exclude leatherbacks and large loggerhead and green turtles; several approved TED designs are structurally weak and do not function properly under normal fishing conditions; and modifications to the trynet and bait shrimp exemptions to the TED requirements are necessary to decrease lethal takes of sea turtles.

December 20, 2001: NMFS issues a 30-day rule (66 FR 65658) imposing an additional restriction on shrimp trawlers required to have a TED installed in each net that is rigged for fishing, operating in Atlantic offshore waters out to 10 nautical miles from the coast of Florida between 28°N latitude and the Georgia-Florida border. Shrimp vessels operating in this area must use the leatherback modification for hard TEDs or the leatherback modification for the Parker soft TED. The restrictions are in response to greatly elevated leatherback sea turtle strandings in the area. The strandings occur during a time when the leatherback contingency plan does not apply, necessitating the use of the 30-day rule.

December 31, 2001: NMFS issues a final rule (66 FR 67495) amending the sea turtle handling and resuscitation regulation.

April-May 2002: NMFS issues three temporary rules (67 FR 20054, April 24, 2002; 67 FR 21585, May 1, 2002; 67 FR 34622, May 15, 2002) to protect leatherback sea turtles within the leatherback conservation zone.

May 30, 2002: NMFS issues a 30-day rule (67 FR 37723) imposing additional restrictions on shrimp trawlers in offshore Atlantic waters west of approximately Cape Fear, North Carolina and north of approximately St. Augustine, Florida. Shrimp fishermen operating in this area are required to use TEDs with escape openings modified to exclude leatherback turtles and are prohibited from fishing at night between one hour after sunset and one hour before sunrise. These restrictions are implemented in response to greatly elevated strandings of loggerhead turtles and an apparent change in effort and behavior of the local fishery.

November 7, 2002: NMFS issues a temporary rule (67 FR 67793) effective through December 2, 2002, to allow the temporary use of limited tow times by shrimp trawlers in Louisiana state waters east of 92° 20'W (approximately at Fresh Water Bayou in Vermilion Parish, Louisiana) and inshore Alabama waters of Bon Secour Bay, Mobile Bay, and Mississippi Sound, south of the Intracoastal Waterway, due to large amounts of debris in the wake of Tropical Storm Isidore and Hurricane Lili.

February 21, 2003: NMFS publishes a final rule amending sea turtle conservation measures to reduce sea turtle mortality in the shrimp trawl fisheries (68 FR 8456). Specifically, it requires the use of larger TEDs to allow the escapement of leatherback and large loggerhead and green sea turtles. The effective date is April 15, 2003, for the South Atlantic, and August 21, 2003, in the Gulf of Mexico.

September 28, 2005: NMFS issues a temporary rule (70 FR 56593) effective through October 24, 2005, to allow the temporary use of limited tow times by shrimp trawlers in state and federal waters from the Florida/Alabama border, westward to the boundary of Cameron Parish, Louisiana (approximately 92°37'W), and extending offshore 50 nautical miles. This action is necessary because environmental conditions resulting from Hurricane Katrina are preventing some fishermen from using TEDs effectively.

October 14, 2005: NMFS issues a temporary rule (70 FR 60013) effective through November 10, 2005, to allow the temporary use of limited tow times by shrimp trawlers in state and federal waters off Cameron Parish, Louisiana (approximately 92°37'W), westward to the boundary shared by Matagorda and Brazoria Counties, Texas, and extending offshore 50 nautical miles. This action is necessary because environmental conditions resulting from Hurricane Rita are preventing some fishermen from using TEDs effectively.

October 27, 2005: NMFS issues a temporary rule (70 FR 61911) effective through November 23, 2005, to allow the temporary use of limited tow times by shrimp trawlers in inshore and offshore waters from the Florida/Alabama border, westward to the boundary shared by Matagorda and Brazoria Counties, Texas, and extending offshore 50 nautical miles. This action is necessary because environmental conditions resulting from Hurricanes Katrina and Rita are preventing some fishermen from using TEDs effectively.

November 24, 2005: NMFS issues a temporary rule (70 FR 71406) effective through December 23, 2005, to allow the temporary use of limited tow times by shrimp trawlers in inshore and offshore waters from the Florida/Alabama border, westward to the boundary shared by Matagorda and Brazoria Counties, Texas, and extending offshore 20 nautical miles. This action is necessary because environmental conditions resulting from Hurricanes Katrina and Rita are preventing some fishermen from using TEDs effectively.

December 29, 2005: NMFS issues a temporary rule (70 FR 77054) effective through January 23, 2006, to allow the temporary use of limited tow times by shrimp trawlers in inshore and offshore waters from the Florida/Alabama border, westward to the Louisiana/Texas border, and extending offshore 20 nautical miles. This action is necessary because environmental conditions resulting from Hurricanes Katrina and Rita are preventing some fishermen from using TEDs effectively.

February 22, 2006: NMFS issues a temporary rule (71 FR 8990) effective through March 20, 2006, to allow the temporary use of limited tow times by shrimp trawlers in inshore and offshore waters from the Florida/Alabama border, westward to the Louisiana/Texas border, and extending offshore 10 nautical miles. This action is necessary because environmental conditions resulting from Hurricanes Katrina and Rita are preventing some fishermen from using TEDs effectively.

October 1, 2008: NMFS issues a temporary rule (73 FR 57010) effective through October 27, 2008, to allow the temporary use of limited tow times by shrimp trawlers in state and federal waters offshore of Louisiana (from the Mississippi/Louisiana boundary to the Texas/Louisiana boundary) extending offshore 20 nautical miles. This action is necessary because environmental conditions resulting from Hurricanes Gustav and Ike are preventing some fishermen from using TEDs effectively.

October 14, 2008: NMFS issues a temporary rule (73 FR 60038) effective through November 7, 2008, to allow the temporary use of limited tow times by shrimp trawlers in state and federal waters offshore of Texas (from the Texas/Louisiana boundary southward to the boundary shared by Matagorda and Brazoria Counties; approximately 95° 32'W) extending offshore 20 nautical miles. This action is necessary because environmental conditions resulting from Hurricane Ike are preventing some fishermen from using TEDs effectively.

November 3, 2008: NMFS issues a temporary rule (73 FR 65277) effective through November 28, 2008, to allow the temporary use of limited tow times by shrimp trawlers in state and federal waters off Louisiana from the western end of Timbalier Island (approximately 90° 33'W) eastward to the Plaquemines/Jefferson Parish line (approximately 89° 54'W), and extending offshore 15 nautical miles. This action is necessary because environmental conditions resulting from Hurricanes Gustav and Ike are preventing some fishermen from using TEDs effectively.

November 12, 2008: NMFS issues a temporary rule (73 FR 66803) effective through December 7, 2008, to allow the temporary use of limited tow times by shrimp trawlers in state and federal waters offshore of Texas (from the Texas/Louisiana boundary southward to the boundary shared by Matagorda and Brazoria Counties; approximately 95° 32'W) extending offshore 9 nautical miles. This action is necessary because environmental conditions resulting from Hurricane Ike are preventing some fishermen from using TEDs effectively.

September 2, 2010: NMFS issues a proposed rule (75 FR 53925) to revise TED requirements to allow the use of new materials and modifications to existing approved TED designs. Specifically, proposed allowable modifications include the use of flat bar, rectangular pipe, and oval pipe as construction materials in currently-approved TED grids; an increase in maximum mesh size on escape flaps from 1⅝ to 2 inches (4.1 to 5.1 cm); the inclusion of the Boone Big Boy TED for use in the shrimp fishery; the use of three large TED and Boone Wedge Cut escape openings; and the use of the Chauvin shrimp deflector to improve shrimp retention. NMFS also proposes to allow a new TED for use in the summer flounder fishery. Additionally, there are proposed corrections to the TED regulations to rectify an oversight regarding the maximum size chain that can be used on the Parker TED escape opening flap, and the proposed addition of a brace bar as an allowable modification to hard TEDs.

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Appendix 2: Sea Turtle Conservation Regulations

§ 222.102 Definitions.

Accelerator funnel means a device used to accelerate the flow of water through a shrimp trawl net.

Act means the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 *et seq.*

. . .

Approved turtle excluder device (TED) means a device designed to be installed in a trawl net forward of the codend for the purpose of excluding sea turtles from the net, as described in 50 CFR 223.207.

. . .

Atlantic Area means all waters of the Atlantic Ocean south of 36°33'00.8" N. lat. (the line of the North Carolina/Virginia border) and adjacent seas, other than waters of the Gulf Area, and all waters shoreward thereof (including ports).

Atlantic Shrimp Fishery—Sea Turtle Conservation Area (Atlantic SFSTCA) means the inshore and offshore waters extending to 10 nautical miles (18.5 km) offshore along the coast of the States of Georgia and South Carolina from the Georgia-Florida border (defined as the line along 30°42'45.6" N. lat.) to the North Carolina-South Carolina border (defined as the line extending in a direction of 135°34'55" from true north from the North Carolina-South Carolina land boundary, as marked by the border station on Bird Island at 33°51'07.9" N. lat., 078°32'32.6" W. long.).

Authorized officer means:

(1) Any commissioned, warrant, or petty officer of the U.S. Coast Guard;

(2) Any special agent or enforcement officer of the National Marine Fisheries Service;

(3) Any officer designated by the head of a Federal or state agency that has entered into an agreement with the Secretary or the Commandant of the Coast Guard to enforce the provisions of the Act; or

(4) Any Coast Guard personnel accompanying and acting under the direction of any person described in paragraph (1) of this definition.

Bait shrimper means a shrimp trawler that fishes for and retains its shrimp catch alive for the purpose of selling it for use as bait.

Beam trawl means a trawl with a rigid frame surrounding the mouth that is towed from a vessel by means of one or more cables or ropes.

Certificate of exemption means any document so designated by the National Marine Fisheries Service and signed by an authorized official of the National Marine Fisheries Service, including any document which modifies, amends, extends or renews any certificate of exemption.

. . .

Commercial activity means all activities of industry and trade, including, but not limited to, the buying or selling of commodities and activities conducted for the purpose of facilitating such buying and selling: Provided, however, that it does not include the exhibition of commodities by museums or similar cultural or historical organizations.

. . .

Fishing, or *to fish,* means:

(1) The catching, taking, or harvesting of fish or wildlife;

(2) The attempted catching, taking, or harvesting of fish or wildlife;

(3) Any other activity that can reasonably be expected to result in the catching, taking, or harvesting of fish or wildlife; or

(4) Any operations on any waters in support of, or in preparation for, any activity described in paragraphs (1) through (3) of this definition.

Footrope means a weighted rope or cable attached to the lower lip (bottom edge) of the mouth of a trawl net along the forward most webbing.

Footrope length means the distance between the points at which the ends of the footrope are attached to the trawl net, measured along the forward-most webbing.

Foreign commerce includes, among other things, any transaction between persons within one foreign country, or between persons in two or more foreign countries, or between a person within the United States and a person in one or more foreign countries, or between persons within the United States, where the fish or wildlife in question are moving in any country or countries outside the United States.

Four-seam, straight-wing trawl means a design of shrimp trawl in which the main body of the trawl is formed from a top panel, a bottom panel, and two side panels of webbing. The upper and lower edges of the side panels of webbing are parallel over the entire length.

Four-seam, tapered-wing trawl means a design of shrimp trawl in which the main body of the trawl is formed from a top panel, a bottom panel, and two side panels of webbing. The upper and lower edges of the side panels of webbing converge toward the rear of the trawl.

Gulf Area means all waters of the Gulf of Mexico west of 81° W. long. (the line at which the Gulf Area meets the Atlantic Area) and all waters shoreward thereof (including ports).

Gulf Shrimp Fishery-Sea Turtle Conservation Area (Gulf SFSTCA) means the offshore waters extending to 10 nautical miles (18.5 km) offshore along the coast of the States of Texas and Louisiana from the South Pass of the Mississippi River (west of 89°08.5' W. long.) to the U.S.-Mexican border.

. . .

Harm in the definition of "take" in the Act means an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering.

Headrope means a rope that is attached to the upper lip (top edge) of the mouth of a trawl net along the forward-most webbing.

Headrope length means the distance between the points at which the ends of the headrope are attached to the trawl net, measured along the forward-most webbing.

Import means to land on, bring into, or introduce into, or attempt to land on, bring into, or introduce into any place subject to the jurisdiction of the United States, whether or not such landing, bringing, or introduction constitutes an importation within the meaning of the tariff laws of the United States.

Inshore means marine and tidal waters landward of the 72 COLREGS demarcation line (International Regulations for Preventing Collisions at Sea, 1972), as depicted or noted on nautical charts published by the National Oceanic and Atmospheric Administration (Coast Charts, 1:80,000 scale) and as described in 33 CFR part 80.

. . .

Office of Enforcement means the national fisheries enforcement office of the National Marine Fisheries Service. Mail sent to the Office of Enforcement should be addressed: Office of Enforcement, F/EN, National Marine Fisheries Service, NOAA, 8484 Suite 415, Georgia Ave., Silver Spring, MD 20910.

Office of Protected Resources means the national program office of the endangered species and marine mammal programs of the National Marine Fisheries Service. Mail sent to the Office of Protected Resources should be addressed: Office of Protected Resources, F/PR, National Marine Fisheries Service, NOAA, 1315 East West Highway, Silver Spring, MD 20910.

Offshore means marine and tidal waters seaward of the 72 COLREGS demarcation line (International Regulations for Preventing Collisions at Sea, 1972), as depicted or noted on nautical charts published by the National Oceanic and Atmospheric Administration (Coast Charts, 1:80,000 scale) and as described in 33 CFR part 80.

Operating conservation program means those conservation management activities which are expressly agreed upon and described in a Conservation Plan or its Implementing Agreement. These activities are to be undertaken for the affected species when implementing an approved Conservation Plan, including measures to respond to changed circumstances.

Permit means any document so designated by the National Marine Fisheries Service and signed by an authorized official of the National Marine Fisheries Service, including any document which modifies, amends, extends, or renews any permit.

Person means an individual, corporation, partnership, trust, association, or any other private entity, or any officer, employee, agent, department, or instrumentality of the Federal government of any state or political subdivision thereof or of any foreign government.

Possession means the detention and control, or the manual or ideal custody of anything that may be the subject of property, for one's use and enjoyment, either as owner or as the proprietor of a qualified right in it, and either held personally or by another who exercises it in one's place and name. Possession includes the act or state of possessing and that condition of facts under which persons can exercise their power over a corporeal thing at their pleasure to the exclusion of all other persons. Possession includes constructive possession that which means not an actual but an assumed existence one claims to hold by virtue of some title, without having actual custody.

. . .

Pusher-head trawl (chopsticks) means a trawl that is spread by two poles suspended from the bow of the trawler in an inverted “V” configuration.

. . .

Roller trawl means a variety of beam trawl that is used, usually by small vessels, for fishing over uneven or vegetated sea bottoms.

. . .

Secretary means the Secretary of Commerce or an authorized representative.

Shrimp means any species of marine shrimp (Order Crustacea) found in the Atlantic Area or the Gulf Area, including, but not limited to:

(1) Brown shrimp (*Penaeus aztecus*).

(2) White shrimp (*Penaeus setiferus*).

(3) Pink shrimp (*Penaeus duorarum*).

(4) Rock shrimp (*Sicyonia brevirostris*).

(5) Royal red shrimp (*Hymenopenaeus robustus*).

(6) Seabob shrimp (*Xiphopenaeus kroyeri*).

Shrimp trawler means any vessel that is equipped with one or more trawl nets and that is capable of, or used for, fishing for shrimp, or whose on-board or landed catch of shrimp is more than 1 percent, by weight, of all fish comprising its on-board or landed catch.

Skimmer trawl means a trawl that is fished along the side of the vessel and is held open by a rigid frame and a lead weight. On its outboard side, the trawl is held open by one side of the frame extending downward and, on its inboard side, by a lead weight attached by cable or rope to the bow of the vessel.

Stretched mesh size means the distance between the centers of the two opposite knots in the same mesh when pulled taut.

. . .

Summer flounder fishery-sea turtle protection area means all offshore waters, bounded on the north by a line along 37°05' N. lat. (Cape Charles, VA) and bounded on the south by a line extending in a direction of 135°34'55" from true north from the North Carolina-South Carolina land boundary, as marked by the border station on Bird Island at 33°51'07.9" N. lat., 078°32'32.6" W. long.(the North Carolina-South Carolina border).

Summer flounder trawler means any vessel that is equipped with one or more bottom trawl nets and that is capable of, or used for, fishing for flounder or whose on-board or landed catch of flounder is more than 100 lb (45.4 kg).

. . .

Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect.

Taper, in reference to the webbing used in trawls, means the angle of a cut used to shape the webbing, expressed as the ratio between the cuts that reduce the width of the webbing by cutting into the panel of webbing through one row of twine (bar cuts) and the cuts that extend the length of the panel of webbing by cutting straight aft through two adjoining rows of twine (point cuts). For example, sequentially cutting through the lengths of twine on opposite sides of a mesh, leaving an uncut edge of twines all lying in the same line, produces a relatively strong taper called “all-bars”; making a sequence of 4-bar cuts followed by 1-point cut produces a more gradual taper called “4 bars to 1 point” or “4b1p”; similarly, making a sequence of 2-bar cuts followed by 1-point cut produces a still more gradual taper called “2b1p”; and making a sequence of cuts straight aft does not reduce the width of the panel and is called a “straight” or “all-points” cut.

Taut means a condition in which there is no slack in the net webbing.

Test net, or *try net*, means a net pulled for brief periods of time just before, or during, deployment of the primary net(s) in order to test for shrimp concentrations or determine fishing conditions (e.g., presence or absence of bottom debris, jellyfish, bycatch, seagrasses, etc.).

Tongue means any piece of webbing along the top, center, leading edge of a trawl, whether lying behind or ahead of the headrope, to which a towing bridle can be attached for purposes of pulling the trawl net and/or adjusting the shape of the trawl.

Transportation means to ship, convey, carry or transport by any means whatever, and deliver or receive for such shipment, conveyance, carriage, or transportation.

Triple-wing trawl means a trawl with a tongue on the top, center, leading edge of the trawl and an additional tongue along the bottom, center, leading edge of the trawl.

Two-seam trawl means a design of shrimp trawl in which the main body of the trawl is formed from a top and a bottom panel of webbing that are directly attached to each other down the sides of the trawl.

Underway with respect to a vessel, means that the vessel is not at anchor, or made fast to the shore, or aground.

Unforeseen circumstances means changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers and NMFS at the time of the conservation plan's negotiation and development, and that result in a substantial and adverse change in the status of the covered species.

Vessel means a vehicle used, or capable of being used, as a means of transportation on water which includes every description of watercraft, including nondisplacement craft and seaplanes.

Vessel restricted in her ability to maneuver has the meaning specified for this term at 33 U.S.C. 2003(g).

. . .

Wing net (butterfly trawl) means a trawl that is fished along the side of the vessel and that is held open by a four-sided, rigid frame attached to the outrigger of the vessel.

[64 FR 14054, Mar. 23, 1999, as amended at 64 FR 60731, Nov. 8, 1999; 67 FR 13101, Mar. 21, 2002; 67 FR 41203, June 17, 2002; 67 FR 71899, Dec. 3, 2002; 68 FR 8467, Feb. 21, 2003; 68 FR 17562, Apr. 10, 2003; 69 FR 25011, May 5, 2004; 70 FR 1832, Jan. 11, 2005; 71 FR 36032, June 23, 2006; 71 FR 50372, Aug. 25, 2006; 74 FR 46933, Sept. 14, 2009]

§ 223.205 Sea turtles.

(a) The prohibitions of section 9 of the Act (16 U.S.C. 1538) relating to endangered species apply to threatened species of sea turtle, except as provided in §223.206.

(b) Except as provided in §223.206, it is unlawful for any person subject to the jurisdiction of the United States to do any of the following:

(1) Own, operate, or be on board a vessel, except if that vessel is in compliance with all applicable provisions of §223.206(d);

(2) Fish for, catch, take, harvest, or possess, fish or wildlife while on board a vessel, except if that vessel is in compliance with all applicable provisions of §223.206(d);

(3) Fish for, catch, take, harvest, or possess, fish or wildlife contrary to any notice of tow-time or other restriction specified in, or issued under, §223.206(d)(3) or (d)(4);

(4) Possess fish or wildlife taken in violation of paragraph (b) of this section;

(5) Fail to follow any of the sea turtle handling and resuscitation requirements specified in §223.206(d)(1);

(6) Possess a sea turtle in any manner contrary to the handling and resuscitation requirements of §223.206(d)(1);

(7) Fail to comply immediately, in the manner specified at §600.730 (b) through (d) of this Title, with instructions and signals specified therein issued by an authorized officer, including instructions and signals to haul back a net for inspection;

(8) Refuse to allow an authorized officer to board a vessel, or to enter an area where fish or wildlife may be found, for the purpose of conducting a boarding, search, inspection, seizure, investigation, or arrest in connection with enforcement of this section;

(9) Destroy, stave, damage, or dispose of in any manner, fish or wildlife, gear, cargo, or any other matter after a communication or signal from an authorized officer, or upon the approach of such an officer or of an enforcement vessel or aircraft, before the officer has an opportunity to inspect same, or in contravention of directions from the officer;

(10) Assault, resist, oppose, impede, intimidate, threaten, obstruct, delay, prevent, or interfere with an authorized officer in the conduct of any boarding, search, inspection, seizure, investigation, or arrest in connection with enforcement of this section;

(11) Interfere with, delay, or prevent by any means, the apprehension of another person, knowing that such person committed an act prohibited by this section;

(12) Resist a lawful arrest for an act prohibited by this section;

(13) Make a false statement, oral or written, to an authorized officer or to the agency concerning the fishing for, catching, taking, harvesting, landing, purchasing, selling, or transferring fish or wildlife, or concerning any other matter subject to investigation under this section by such officer, or required to be submitted under this part 223;

(14) Sell, barter, trade or offer to sell, barter, or trade, a TED that is not an approved TED;

. . .

(22) Attempt to do, solicit another to do, or cause to be done, any of the foregoing.

(c) In connection with any action alleging a violation of this section, any person claiming the benefit of any exemption, exception, or permit under this subpart B has the burden of proving that the exemption, exception, or permit is applicable, was granted, and was valid and in force at the time of the alleged violation. Further, any person claiming that a modification made to a TED that is the subject of such an action complies with the requirements of §223.207 (c) or (d) has the burden of proving such claim.

[64 FR 14069, Mar. 23, 1999, as amended at 67 FR 41203, June 17, 2002; 69 FR 25012, May 5, 2004; 71 FR 50372, Aug. 25, 2006; 73 FR 68354, Nov. 18, 2008]

§ 223.206 Exceptions to prohibitions relating to sea turtles.

(a) *Permits* —(1) *Scientific research, education, zoological exhibition, or species enhancement permits.* The Assistant Administrator may issue permits authorizing activities which would otherwise be prohibited under §223.205(a) for scientific or educational purposes, for zoological exhibition, or to enhance the propagation or survival of threatened species of sea turtles, in accordance with and subject to the conditions of part 222, subpart C—General Permit Procedures.

(2) *Incidental-take permits.* The Assistant Administrator may issue permits authorizing activities that would otherwise be prohibited under §223.205(a) in accordance with section 10(a)(1)(B) of the Act (16 U.S.C. 1539(a)(1)(B)), and in accordance with, and subject to, the implementing regulations in part 222 of this chapter. Such permits may be issued for the incidental taking of threatened and endangered species of sea turtles.

. . .

(d) *Exception for incidental taking* . The prohibitions against taking in §223.205(a) do not apply to the incidental take of any member of a threatened species of sea turtle (i.e., a take not directed towards such member) during fishing or scientific research activities, to the extent that those involved are in compliance with all applicable requirements of paragraphs (d)(1) through (d)(11) of this section, or in compliance with the terms and conditions of an incidental take permit issued pursuant to paragraph (a)(2) of this section.

(1) *Handling and resuscitation requirements.* (i) Any specimen taken incidentally during the course of fishing or scientific research activities must be handled with due care to prevent injury to live specimens, observed for activity, and returned to the water according to the following procedures:

(A) Sea turtles that are actively moving or determined to be dead as described in paragraph (d)(1)(i)(C) of this section must be released over the stern of the boat. In addition, they must be released only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels.

(B) Resuscitation must be attempted on sea turtles that are comatose, or inactive, as determined in paragraph (d)(1) of this section, by:

(*1*) Placing the turtle on its bottom shell (plastron) so that the turtle is right side up and elevating its hindquarters at least 6 inches (15.2 cm) for a period of 4 up to 24 hours. The amount of the elevation depends on the size of the turtle; greater elevations are needed for larger turtles. Periodically, rock the turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about 3 inches (7.6 cm) then alternate to the other side. Gently touch the eye and pinch the tail (reflex test) periodically to see if there is a response.

(*2*) Sea turtles being resuscitated must be shaded and kept damp or moist but under no circumstance be placed into a container holding water. A water-soaked towel placed over the head, carapace, and flippers is the most effective method in keeping a turtle moist.

(*3*) Sea turtles that revive and become active must be released over the stern of the boat only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels. Sea turtles that fail to respond to the reflex test or fail to move within 4 hours (up to 24, if possible) must be returned to the water in the same manner as that for actively moving turtles.

(C) A turtle is determined to be dead if the muscles are stiff (rigor mortis) and/or the flesh has begun to rot; otherwise the turtle is determined to be comatose or inactive and resuscitation attempts are necessary.

(ii) In addition to the provisions of paragraph (d)(1)(i) of this section, a person aboard a vessel in the Atlantic, including the Caribbean Sea and the Gulf of Mexico, that has pelagic or bottom longline gear on board and that has been issued, or is required to have, a limited access permit for highly migratory species under §635.4 of this title, must comply with the handling and release requirements specified in §635.21 of this title.

(iii) Any specimen taken incidentally during the course of fishing or scientific research activities must not be consumed, sold, landed, offloaded, transshipped, or kept below deck.

(2) *Gear requirements for trawlers* —(i) *TED requirement for shrimp trawlers.* Any shrimp trawler that is in the Atlantic Area or Gulf Area must have an approved TED installed in each net that is rigged for fishing. A net is rigged for fishing if it is in the water, or if it is shackled, tied,

or otherwise connected to any trawl door or board, or to any tow rope, cable, pole or extension, either on board or attached in any manner to the shrimp trawler. Exceptions to the TED requirement for shrimp trawlers are provided in paragraph (d)(2)(ii) of this section.

(ii) *Exemptions from the TED requirement* —(A) *Alternative tow-time restrictions.* A shrimp trawler is exempt from the TED requirements of paragraph (d)(2)(i) of this section if it complies with the alternative tow-time restrictions in paragraph (d)(3)(i) of this section and if it:

(*1*) Has on board no power or mechanical-advantage trawl retrieval system (i.e., any device used to haul any part of the net aboard);

(*2*) Is a bait shrimper that retains all live shrimp on board with a circulating seawater system, if it does not possess more than 32 lb. (14.5 kg) of dead shrimp on board, if it has a valid original state bait-shrimp license, and if the state license allows the licensed vessel to participate in the bait shrimp fishery exclusively;

(*3*) Has only a pusher-head trawl, skimmer trawl, or wing net rigged for fishing;

(*4*) Is in an area during a period for which tow-time restrictions apply under paragraphs (d)(3)(ii) or (iii) of this section, if it complies with all applicable provisions imposed under those paragraphs; or

(*5*) Is using a single test net (try net) with a headrope length of 12 ft (3.6 m) or less and with a footrope length of 15 ft (4.6 m) or less, if it is pulled immediately in front of another net or is not connected to another net in any way, if no more than one test net is used at a time, and if it is not towed as a primary net, in which case the exemption under this paragraph (d)(2)(ii)(A) applies to the test net.

(B) *Exempted gear or activities.* The following fishing gear or activities are exempted from the TED requirements of paragraph (d)(2)(i) of this section:

(*1*) A beam or roller trawl, if the frame is outfitted with rigid vertical bars, and if none of the spaces between the bars, or between the bars and the frame, exceeds 4 inches (10.2 cm); and

(*2*) A shrimp trawler fishing for, or possessing, royal red shrimp, if royal red shrimp constitutes at least 90 percent (by weight) of all shrimp either found on board, or offloaded from that shrimp trawler.

. . .

(3) *Tow-time restrictions* —(i) *Duration of tows.* If tow-time restrictions are utilized pursuant to paragraph (d)(2)(ii), (d)(3)(ii), or (d)(3)(iii) of this section, a shrimp trawler must limit tow times. The tow time is measured from the time that the trawl door enters the water until it is removed from the water. For a trawl that is not attached to a door, the tow time is measured from the time the codend enters the water until it is removed from the water. Tow times may not exceed:

(A) 55 minutes from April 1 through October 31; and

(B) 75 minutes from November 1 through March 31.

(ii) *Alternative—special environmental conditions.* The Assistant Administrator may allow compliance with tow-time restrictions, as an alternative to the TED requirement of paragraph (d)(2)(i) of this section, if the Assistant Administrator determines that the presence of algae, seaweed, debris or other special environmental conditions in a particular area makes trawling with TED-equipped nets impracticable.

(iii) *Substitute—ineffectiveness of TEDs.* The Assistant Administrator may require compliance with tow-time restrictions, as a substitute for the TED requirement of paragraph (d)(2)(i) of this section, if the Assistant Administrator determines that TEDs are ineffective in protecting sea turtles.

(iv) *Notice; applicability; conditions.* The Assistant Administrator will publish notification concerning any tow-time restriction imposed under paragraph (d)(3)(ii) or (iii) of this section in the Federal Register and will announce it in summary form on channel 16 of the marine VHF radio. A notification of tow-time restrictions will include findings in support of these restrictions as an alternative to, or as substitute for, the TED requirements. The notification will specify the effective dates, the geographic area where tow-time restrictions apply, and any applicable conditions or restrictions that the Assistant Administrator determines are necessary or appropriate to protect sea turtles and ensure compliance, including, but not limited to, a requirement to carry observers, to register vessels in accordance with procedures at paragraph (d)(5) of this section, or for all shrimp trawlers in the area to synchronize their tow times so that all trawl gear remains out of the water during certain times. A notification withdrawing tow-time restrictions will include findings in support of that action.

(v) *Procedures.* The Assistant Administrator will consult with the appropriate fishery officials (state or Federal) where the affected shrimp fishery is located in issuing a notification concerning tow-time restrictions. An emergency notification can be effective for a period of up to 30 days and may be renewed for additional periods of up to 30 days each if the Assistant Administrator finds that the conditions necessitating the imposition of tow-time restrictions continue to exist. The Assistant Administrator may invite comments on such an action, and may withdraw or modify the action by following procedures similar to those for implementation. The Assistant Administrator will implement any permanent tow-time restriction through rulemaking.

(4) *Limitations on incidental takings during fishing activities* —(i) *Limitations.* The exemption for incidental takings of sea turtles in paragraph (d) of this section does not authorize incidental takings during fishing activities if the takings:

(A) Would violate the restrictions, terms, or conditions of an incidental take statement or biological opinion;

(B) Would violate the restrictions, terms, or conditions of an incidental take permit; or

(C) May be likely to jeopardize the continued existence of a species listed under the Act.

(ii) *Determination; restrictions on fishing activities.* The Assistant Administrator may issue a determination that incidental takings during fishing activities are unauthorized. Pursuant thereto, the Assistant Administrator may restrict fishing activities in order to conserve a species listed under the Act, including, but not limited to, restrictions on the fishing activities of vessels subject to paragraph (d)(2) of this section. The Assistant Administrator will take such action if the Assistant Administrator determines that restrictions are necessary to avoid unauthorized takings that may be likely to jeopardize the continued existence of a listed species. The Assistant Administrator may withdraw or modify a determination concerning unauthorized takings or any restriction on fishing activities if the Assistant Administrator determines that such action is warranted.

(iii) *Notice; applicability; conditions.* The Assistant Administrator will publish a notification of a determination concerning unauthorized takings or a notification concerning the restriction of fishing activities in the Federal Register. The Assistant Administrator will provide as much advance notice as possible, consistent with the requirements of the Act, and will announce the notification in summary form on channel 16 of the marine VHF radio. Notification of a determination concerning unauthorized takings will include findings in support of that determination; specify the fishery, including the target species and gear used by the fishery, the area, and the times, for which incidental takings are not authorized; and include such other conditions and restrictions as the Assistant Administrator determines are necessary or appropriate to protect sea turtles and ensure compliance. Notification of restriction of fishing activities will include findings in support of the restriction, will specify the time and area where the restriction is applicable, and will specify any applicable conditions or restrictions that the Assistant Administrator determines are necessary or appropriate to protect sea turtles and ensure compliance. Such conditions and restrictions may include, but are not limited to, limitations on the types of fishing gear that may be used, tow-time restrictions, alteration or extension of the periods of time during which particular tow-time requirements apply, requirements to use TEDs, registration of vessels in accordance with procedures at paragraph (d)(5) of this section, and requirements to provide observers. Notification of withdrawal or modification will include findings in support of that action.

(iv) *Procedures.* The Assistant Administrator will consult with the appropriate fisheries officials (state or Federal) where the fishing activities are located in issuing notification of a determination concerning unauthorized takings or notification concerning the restriction of fishing activities. An emergency notification will be effective for a period of up to 30 days and may be renewed for additional periods of up to 30 days each, except that emergency placement of observers will be effective for a period of up to 180 days and may be renewed for an additional period of 60 days. The Assistant Administrator may invite comments on such action, and may withdraw or modify the action by following procedures similar to those for implementation. The Assistant Administrator will implement any permanent determination or restriction through rulemaking.

(5)–(6) [Reserved]

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[64 FR 14070, Mar. 23, 1999]

Editorial Note: For Federal Register citations to §223.206, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and at www.fdsys.gov.

Effective Date Notes: 1. At 64 FR 14070, Mar. 23, 1999, newly redesignated §223.206 was revised. Paragraph (d)(5) contains information collection and recordkeeping requirements and will not become effective until approval has been given by the Office of Management and Budget.

2. At 67 FR 41203, June 17, 2002, §223.206 was amended by adding paragraph (d)(2)(v). Paragraph (d)(2)(v)(C) contains information collection and recordkeeping requirements and will not become effective until approval has been given by the Office of Management and Budget.

§ 223.207 Approved TEDs.

Any netting, webbing, or mesh that may be measured to determine compliance with this section is subject to measurement, regardless of whether it is wet or dry. Any such measurement will be of the stretched mesh size.

(a) *Hard TEDs.* Hard TEDs are TEDs with rigid deflector grids and are categorized as “hooped hard TEDs” and “single-grid hard TEDs” such as the Matagorda and Georgia TED (Figures 3 & 4 to this part). Hard TEDs complying with the following generic design criteria are approved TEDs:

(1) *Construction materials* —(i) *Single-grid and inshore hooped hard TED.* A single-grid hard TED or an inshore hooped hard TED must be constructed of one or a combination of the following materials, with minimum dimensions as follows:

(A) Solid steel rod with a minimum outside diameter of 1/4 inch (0.64 cm);

(B) Fiberglass or aluminum rod with a minimum outside diameter of 1/2 inch (1.27 cm); or

(C) Steel or aluminum tubing with a minimum outside diameter of 1/2 inch (1.27 cm) and a minimum wall thickness of 1/8 inch (0.32 cm) (also known as schedule 40 tubing).

(ii) *Offshore hooped hard TED.* An offshore hooped hard TED must be constructed of aluminum, with minimum dimensions as follows:

(A) Solid rod with a minimum outside diameter of 5/8 inch (1.59 cm); or

(B) Tubing with a minimum outside diameter of 1 inch (2.54 cm) and a minimum wall thickness of 1/8 inch (0.32 cm).

(2) *Method of attachment.* A hard TED must be sewn into the trawl around the entire circumference of the TED with heavy twine.

(3) *Angle of deflector bars.* (i) The angle of the deflector bars must be between 30° and 55° from the normal, horizontal flow through the interior of the trawl, except as provided in paragraph (a)(3)(ii) of this section.

(ii) For any shrimp trawler fishing in the Gulf SFSTCA or the Atlantic SFSTCA, a hard TED with the position of the escape opening at the bottom of the net when the net is in its deployed position, the angle of the deflector bars from the normal, horizontal flow through the interior of the trawl, at any point, must not exceed 55°, and the angle of the bottom-most 4 inches (10.2 cm) of each deflector bar, measured along the bars, must not exceed 45° (Figures 14a and 14b to this part).

(4) *Space between bars.* The space between deflector bars and the deflector bars and the TED frame must not exceed 4 inches (10.2 cm).

(5) *Direction of bars.* The deflector bars must run from top to bottom of the TED, as the TED is positioned in the net, except that up to four of the bottom bars and two of the top bars, including the frame, may run from side to side of the TED. The deflector bars must be permanently attached to the TED frame or to the horizontal bars, if used, at both ends.

(6) *Position of the escape opening.* The escape opening must be made by removing a rectangular section of webbing from the trawl, except for a TED with an escape opening size described at paragraph (a)(7)(ii)(A) for which the escape opening may alternatively be made by making a horizontal cut along the same plane as the TED. The escape opening must be centered on and immediately forward of the frame at either the top or bottom of the net when the net is in the deployed position. The escape opening must be at the top of the net when the slope of the deflector bars from forward to aft is upward, and must be at the bottom when such slope is downward. The passage from the mouth of the trawl through the escape opening must be completely clear of any obstruction or modification, other than those specified in paragraph (d) of this section.

(7) *Size of escape opening* —(i) *Hooped hard TEDs* —(A) *Escape opening for inshore hooped hard TED.* The inshore hooped hard TED escape opening must have a horizontal measurement of no less than 35 inches (89 cm) wide and a forward measurement of no less than 27 inches (69 cm). A hinged door frame may be used to partially cover the escape opening as provided in paragraph (d)(7) of this section. Alternatively, a webbing flap may be used as provided in paragraph (d)(3)(i) of this section. The resultant opening with a webbing flap must be a minimum width of 35 inches (89 cm) and a minimum height of 20 inches (51 cm), with each measurement taken simultaneously. This opening may only be used in inshore waters, except it may not be used in the inshore waters of Georgia and South Carolina.

(B) *Escape opening for offshore hooped hard TED.* The offshore hooped hard TED escape opening must have a horizontal measurement of no less than 40 inches (102 cm) wide and a forward measurement of no less than 35 inches (89 cm). A hinged door frame may be used to partially cover the escape opening as provided in paragraph (d)(7) of this section. Alternatively, a webbing flap may be used as provided in paragraph (d)(3)(ii) of this section. The resultant escape opening with a webbing flap must have a stretched mesh circumference of no less than 142 inches (361 cm).

(ii) *Single-grid hard TEDs.* On a single-grid hard TED, the horizontal cut(s) for the escape opening may not be narrower than the outside width of the TED frame minus 4 inches (10.2 cm) on both sides of the grid, when measured as a straight line width. Fore-and-aft cuts to remove a rectangular piece of webbing must be made from the ends of the horizontal cuts along a single row of meshes along each side. The overall size of the escape opening must match one of the following specifications:

(A) *44–inch inshore opening.* The escape opening must have a minimum width of 44 inches (112 cm) and a minimum height of 20 inches (51 cm) with each measurement taken separately. A webbing flap, as described in paragraph (d)(3)(i) of this section, may be used with this escape hole, so long as this minimum opening size is achieved. This opening may only be used in inshore waters, except it may not be used in the inshore waters of Georgia and South Carolina.

(B) *The 71–inch offshore opening* : The two forward cuts of the escape opening must not be less than 26 inches (66 cm) long from the points of the cut immediately forward of the TED frame. The resultant length of the leading edge of the escape opening cut must be no less than 71 inches (181 cm) with a resultant circumference of the opening being 142 inches (361 cm) (Figure 12 to this part). A webbing flap, as described in paragraph (d)(3)(ii) of this section, may be used with this escape hole, so long as this minimum opening size is achieved. Either this opening or the one described in paragraph (a)(7)(ii)(C) of this section must be used in all offshore waters and in all inshore waters in Georgia and South Carolina, but may also be used in other inshore waters.

(C) *Double cover offshore opening.* The two forward cuts of the escape opening must not be less than 20 inches (51 cm) long from the points of the cut immediately forward of the TED frame. The resultant length of the leading edge of the escape opening cut must be no less than 56 inches (142 cm)(Figure 16 to this part illustrates the dimensions of these cuts). A webbing flap, as described in paragraph (d)(3)(iii) of this section, may be used with this escape hole. Either this opening or the one described in paragraph (a)(7)(ii)(B) of this section must be used in all offshore waters but also in all inshore waters in Georgia and South Carolina, and may be used in other inshore waters.

(8) *Size of hoop or grid* —(i) *Hooped hard TED* —(A) *Inshore hooped hard TED.* The front hoop on an inshore hooped hard TED must have an inside horizontal measurement of at least 35 inches (89 cm) and an inside vertical measurement of at least 30 inches (76 cm). The minimum clearance between the deflector bars and the forward edge of the escape opening must be at least 20 inches (51 cm).

(B) *Offshore hooped hard TED.* The front hoop on an offshore hooped hard TED must have an inside horizontal measurement of at least 40 inches (102 cm) and an inside vertical measurement of at least 30 inches (76 cm). The minimum clearance between the deflector bars and the forward edge of the escape opening must be at least 23 1/4 inches (59 cm).

(ii) *Single-grid hard TED.* A single-grid hard TED must have a minimum outside horizontal and vertical measurement of 32 inches (81 cm). The required outside measurements must be at the mid-point of the deflector grid.

(9) *Flotation.* Floats must be attached to the top one-half of all hard TEDs with bottom escape openings. The floats may be attached either outside or inside the net, but not to a flap. Floats attached inside the net must be behind the rear surface of the TED. Floats must be attached with heavy twine or rope. Floats must be constructed of aluminum, hard plastic, expanded polyvinyl chloride, or expanded ethylene vinyl acetate unless otherwise specified. The requirements of this paragraph may be satisfied by compliance with either the dimension requirements of paragraph (a)(9)(i) of this section, or the buoyancy requirements of paragraph (a)(9)(ii) of this section, or the buoyancy-dimension requirements of paragraph (a)(9)(iii) of this section. If roller gear is used pursuant to paragraph (d)(5) of this section, the roller gear must be included in the circumference measurement of the TED or the total weight of the TED.

(i) *Float dimension requirements.* (A) For hard TEDs with a circumference of 120 inches (304.8 cm) or more, a minimum of either one round, aluminum or hard plastic float, no smaller than 9.8 inches (25.0 cm) in diameter, or two expanded polyvinyl chloride or expanded ethylene vinyl acetate floats, each no smaller than 6.75 inches (17.2 cm) in diameter by 8.75 inches (22.2 cm) in length, must be attached.

(B) For hard TEDs with a circumference of less than 120 inches (304.8 cm), a minimum of either one round, aluminum or hard plastic float, no smaller than 9.8 inches (25.0 cm) in diameter, or one expanded polyvinyl chloride or expanded ethylene vinyl acetate float, no smaller than 6.75 inches (17.2 cm) in diameter by 8.75 inches (22.2 cm) in length, must be attached.

(ii) *Float buoyancy requirements.* Floats of any size and in any combination must be attached such that the combined buoyancy of the floats, as marked on the floats, equals or exceeds the weight of the hard TED, as marked on the TED. The buoyancy of the floats and the weight of the TED must be clearly marked on the floats and the TED as follows:

(A) *Float buoyancy markings.* Markings on floats must be made in clearly legible raised or recessed lettering by the original manufacturer. The marking must identify the buoyancy of the float in water, expressed in grams or kilograms, and must include the metric unit of measure. The marking may additionally include the buoyancy in English units. The marking must identify the nominal buoyancy for the manufactured float.

(B) *TED weight markings.* The marking must be made by the original TED manufacturer and must be permanent and clearly legible. The marking must identify the in-air, dry weight of the TED, expressed in grams or kilograms, and must include the metric unit of measure. The marking may additionally include the weight in English units. The marked weight must represent the actual weight of the individual TED as manufactured. Previously manufactured TEDs may be marked upon return to the original manufacturer. Where a TED is comprised of multiple detachable components, the weight of each component must be separately marked.

(iii) *Buoyancy-dimension requirements.* Floats of any size and in any combination, provided that they are marked pursuant to paragraph (a)(9)(ii)(A) of this section, must be attached such that the combined buoyancy of the floats equals or exceeds the following values:

(A) For floats constructed of aluminum or hard plastic, regardless of the size of the TED grid, the combined buoyancy must equal or exceed 14 lb (6.4 kg);

(B) For floats constructed of expanded polyvinyl chloride or expanded ethylene vinyl acetate, where the circumference of the TED is 120 inches (304.8 cm) or more, the combined buoyancy must equal or exceed 20 lb (9.1 kg); or

(C) For floats constructed of expanded polyvinyl chloride or expanded ethylene vinyl acetate, where the circumference of the TED is less than 120 inches (304.8 cm), the combined buoyancy must equal or exceed 10 lb (4.5 kg).

(b) *Special Hard TEDs.* Special hard TEDs are hard TEDs which do not meet all of the design and construction criteria of the generic standards specified in paragraph (a) of this section. The following special hard TEDs are approved TEDs:

. . .

(2) *Weedless TED.* The weedless TED must meet all the requirements of paragraph (a) of this section for single-grid hard TEDs, with the exception of paragraphs (a)(1) and (a)(5) of this section. The weedless TED must be constructed of at least 1–1/4 inch (3.2 cm) outside diameter aluminum with a wall thickness of at least 1/8 inch (0.3 cm). The deflector bars must run from top to bottom of the TED, as the TED is positioned in the net. The ends of the deflectors bars on the side of the frame opposite to the escape opening must be permanently attached to the frame. The ends of the deflector bars nearest the escape opening are not attached to the frame and must lie entirely forward of the leading edge of the outer frame. The ends of the unattached deflector bars must be no more than 4 inches (10.2 cm) from the frame and may not extend past the frame. A horizontal brace bar to reinforce the deflector bars, constructed of the same size or larger pipe as the deflector bars, must be permanently attached to the frame and the rear face of each of the deflector bars at a position anywhere between the vertical mid-point of the frame and the unattached ends of the deflector bars. The horizontal brace bar may be offset behind the deflector bars, using spacer bars, not to exceed 5 inches (12.7 cm) in length and constructed of the same size or larger pipe as the deflector bars. See Figure 15.

(c) *Soft TEDs.* Soft TEDs are TEDs with deflector panels made from polypropylene or polyethylene netting. The following soft TEDs are approved TEDs:

(1) *Parker TED.* The Parker TED is a soft TED, consisting of a single triangular panel, composed of webbing of two different mesh sizes, that forms a complete barrier inside a trawl and that angles toward an escape opening in the top of the trawl.

(i) *Excluder Panel.* (Figure 5 to this part) The excluder panel of the Parker TED must be constructed of a single triangular piece of 8-inch (20.3 cm) stretched mesh webbing and two trapezoidal pieces of 4-inch (10.2-cm) stretched mesh webbing. The webbing must consist of number 48 (3-mm thick) or larger polypropylene or polyethylene webbing that is heat-set knotted or braided. The leading edge of the 8-inch (20.3-cm) mesh panel must be 36 meshes wide. The 8-inch (20.3-cm) mesh panel must be tapered on each side with all-bar cuts to converge on an apex, such that the length of each side is 36 bars. The leading edges of the 4-inch (10.2-cm) mesh panels must be 8 meshes wide. The edges of the 4-inch (10.2-cm) mesh panels must be cut with all-bar cuts running parallel to each other, such that the length of the inner edge is 72 bars and the length of the outer edge is 89 bars and the resulting fore-and-aft edge is 8 meshes deep. The two 4-inch (10.2-cm) mesh panels must be sewn to the 8-inch (20.3-cm) mesh panel to create a single triangular excluder panel. The 72-bar edge of each 4-inch (10.2-cm) mesh panel must be securely joined with twine to one of the 36-bar edges of the 8-inch (20.3-cm) mesh panel, tied with knots at each knot of the 4-inch (10.2-cm) webbing and at least two wraps of twine around each bar of 4-inch (10.2-cm) mesh and the adjoining bar of the 8-inch (20.3-cm) mesh. The adjoining fore-and-aft edges of the two 4-inch (10.2-cm) mesh panels must be sewn together evenly.

(ii) *Limitations on which trawls may have a Parker TED installed.* The Parker TED must not be installed or used in a two-seam trawl with a tongue, nor in a triple-wing trawl (a trawl with a tongue along the headrope and a second tongue along the footrope). The Parker TED may be installed and used in any other trawl if the taper of the body panels of the trawl does not exceed 4b1p and if it can be properly installed in compliance with paragraph (c)(1)(iii) of this section.

(iii) *Panel installation* —(A) *Leading edge attachment.* The leading edge of the excluder panel must be attached to the inside of the bottom of the trawl across a straight row of meshes. For a two-seam trawl or a four-seam, tapered-wing trawl, the row of meshes for attachment to the trawl must run the entire width of the bottom body panel, from seam to seam. For a four-seam, straight-wing trawl, the row of meshes for attachment to the trawl must run the entire width of the bottom body panel and half the height of each wing panel of the trawl. Every mesh of the leading edge of the excluder panel must be evenly sewn to this row of meshes; meshes may not be laced to the trawl. The row of meshes for attachment to the trawl must contain the following number of meshes, depending on the stretched mesh size used in the trawl:

(*1*) For a mesh size of 21/4inches (5.7 cm), 152–168 meshes;

(*2*) For a mesh size of 21/8inches (5.4 cm), 161–178 meshes;

(*3*) For a mesh size of 2 inches (5.1 cm), 171–189 meshes;

(*4*) For a mesh size of 17/8inches (4.8 cm), 182–202 meshes;

(*5*) For a mesh size of 13/4inches (4.4 cm), 196–216 meshes;

(*6*) For a mesh size of 15/8inches (4.1 cm), 211–233 meshes;

(*7*) For a mesh size of 11/2inches (3.8 cm), 228–252 meshes;

(*8*) For a mesh size of 13/8inches (3.5 cm), 249–275 meshes; and

(*9*) For a mesh size of 11/4inches (3.2 cm), 274–302 meshes.

(B) *Apex attachment.* The apex of the triangular excluder panel must be attached to the inside of the top body panel of the trawl at the centerline of the trawl. The distance, measured aft along the centerline of the top body panel from the same row of meshes for attachment of the excluder panel to the bottom body panel of the trawl, to the apex attachment point must contain the following number of meshes, depending on the stretched mesh size used in the trawl:

(*1*) For a mesh size of 21/4inches (5.7 cm), 78–83 meshes;

(*2*) For a mesh size of 21/8inches (5.4 cm), 83–88 meshes;

(*3*) For a mesh size of 2 inches (5.1 cm), 87–93 meshes;

(*4*) For a mesh size of 17/8inches (4.8 cm), 93–99 meshes;

(*5*) For a mesh size of 13/4inches (4.4 cm), 100–106 meshes;

(*6*) For a mesh size of 15/8inches (4.1 cm), 107–114 meshes;

(*7*) For a mesh size of 11/2inches (3.8 cm), 114–124 meshes;

(*8*) For a mesh size of 13/8inches (3.5 cm), 127–135 meshes; and

(*9*) For a mesh size of 11/4inches (3.2 cm), 137–146 meshes.

(C) *Side attachment.* The sides of the excluder panel must be attached evenly to the inside of the trawl from the outside attachment points of the excluder panel's leading edge to the apex of the excluder panel. Each side must be sewn with the same sewing sequence, and, if the sides of the excluder panel cross rows of bars in the trawl, the crossings must be distributed evenly over the length of the side attachment.

(iv) *Escape opening.* The escape opening for the Parker soft TED must match one of the following specifications:

(A) *Inshore opening.* This opening is the minimum size opening that may be used in inshore waters, except it may not be used in the inshore waters of Georgia and South Carolina, in which a larger minimum opening is required. A slit at least 56 inches (1.4 m) in taut length must be cut along the centerline of the top body panel of the trawl net immediately forward of the apex of the panel webbing. The slit must not be covered or closed in any manner. The edges and end points of the slit must not be reinforced in any way; for example, by attaching additional rope or webbing or by changing the orientation of the webbing.

(B) *Offshore opening.* A horizontal cut extending from the attachment of one side of the deflector panel to the trawl to the attachment of the other side of the deflector panel to the trawl must be made in a single row of meshes across the top of the trawl and measure at least 96 inches (244 cm) in taut width. All trawl webbing above the deflector panel between the 96-inch (244-cm) cut and edges of the deflector panel must be removed. A rectangular flap of nylon webbing not larger than 2-inch (5.1-cm) stretched mesh may be sewn to the forward edge of the escape opening. The width of the flap must not be larger than the width of the forward edge of the escape opening. The flap must not extend more than 12 inches (30.4 cm) beyond the rear point of the escape opening. The sides of the flap may be attached to the top of the trawl but must not be attached farther aft than the row of meshes through the rear point of the escape opening. One row of steel chain not larger than3/16inch (4.76 mm) may be sewn evenly to the back edge of the flap. The stretched length of the chain must not exceed 96 inches (244 cm). A Parker TED using the escape opening described in this paragraph meets the requirements of §223.206(d)(2)(iv)(B). This opening or one that is larger must be used in all offshore waters and in the inshore waters of Georgia and South Carolina. It also may be used in other inshore waters.

(2) [Reserved]

(d) *Allowable modifications to hard TEDs and special hard TEDs.* Unless otherwise prohibited in paragraph (b) of this section, only the following modifications may be made to an approved hard TED or an approved special hard TED:

(1) *Floats.* In addition to floats required pursuant to paragraph (a)(9) of this section, floats may be attached to the top one-half of the TED, either outside or inside the net, but not to a flap. Floats attached inside the net must be behind the rear surface at the top of the TED.

(2) *Accelerator funnel.* An accelerator funnel may be installed in the trawl, if it is made of net webbing material with a stretched mesh size of not greater than 1 5/8 inches (4 cm), if it is inserted in the net immediately forward of the TED, and if its rear edge does not extend past the bars of the TED. The trailing edge of the accelerator funnel may be attached to the TED on the side opposite the escape opening if not more than one-third of the circumference of the funnel is attached, and if the inside horizontal opening as described above in maintained. In a bottom opening TED only the top one-third of the circumference of the funnel may be attached to the TED. In a top opening TED only the bottom one-third of the circumference of the funnel may be attached to the TED.

(i) In inshore waters, other than the inshore waters of Georgia and South Carolina in which a larger opening is required, the inside horizontal opening of the accelerator funnel must be at least 44 inches (112 cm).

(ii) In offshore waters and the inshore waters of Georgia and South Carolina, the inside horizontal opening of the accelerator funnel must be at least 71 inches (180 cm).

(3) *Webbing flap.* A webbing flap may be used to cover the escape opening under the following conditions: No device holds it closed or otherwise restricts the opening; it is constructed of webbing with a stretched mesh size no larger than 1–5/8 inches (4 cm); it lies on the outside of the trawl; it is attached along its entire forward edge forward of the escape opening; it is not attached on the sides beyond the row of meshes that lies 6 inches (15 cm) behind the posterior edge of the grid; the sides of the flap are sewn on the same row of meshes fore and aft; and the flap does not overlap the escape hole cut by more than 5 inches (13 cm) on either side.

(i) *44–inch inshore TED flap.* This flap may not extend more than 24 inches (61 cm) beyond the posterior edge of the grid.

(ii) *71–inch offshore TED Flap.* The flap must be a 133–inch (338–cm) by 52–inch (132–cm) piece of webbing. The 133–inch (338–cm) edge of the flap is attached to the forward edge of the opening (71–inch (180–cm) edge). The flap may extend no more than 24 inches (61 cm) behind the posterior edge of the grid (Figure 12 to this part illustrates this flap).

(iii) *Double cover flap offshore TED flap.* This flap must be composed of two equal size rectangular panels of webbing. Each panel must be no less than 58 inches (147 cm) wide and may overlap each other no more than 15 inches (38 cm). The panels may only be sewn together along the leading edge of the cut. The trailing edge of each panel must not extend more than 24 inches (61 cm) past the posterior edge of the grid (Figure 16 to this part). Each panel may be sewn down the entire length of the outside edge of each panel. Chafing webbing described in paragraph (d)(4) of this section may not be used with this type of flap.

(A) *Edge lines.* Optional edge lines can be used in conjunction with this flap. The line must be made of polyethylene with a maximum diameter of 3/8 inches (.95 cm). A single length of line must be used for each flap panel. The line must be sewn evenly to the unattached, inside edges and trailing edges, of each flap panel. When edge lines are installed, the outside edge of each flap panel must be attached along the entire length of the flap panel.

(B) [Reserved]

(4) *Chafing webbing.* A single piece of nylon webbing, with a twine size no smaller than size 36 (2.46 mm in diameter), may be attached outside of the escape opening webbing flap to prevent chafing on bottom opening TEDs. This webbing may be attached along its leading edge only. This webbing may not extend beyond the trailing edge or sides of the existing escape opening webbing flap, and it must not interfere or otherwise restrict the turtle escape opening.

(5) *Roller gear.* Roller gear may be attached to the bottom of a TED to prevent chafing on the bottom of the TED and the trawl net. When a webbing flap is used in conjunction with roller gear, the webbing flap must be of a length such that no part of the webbing flap can touch or come in contact with any part of the roller gear assembly or the means of attachment of the roller

gear assembly to the TED, when the trawl net is in its normal, horizontal position. Roller gear must be constructed according to one of the following design criteria:

(i) A single roller consisting of hard plastic shall be mounted on an axle rod, so that the roller can roll freely about the axle. The maximum diameter of the roller shall be 6 inches (15.24 cm), and the maximum width of the axle rod shall be 12 inches (30.4 cm). The axle rod must be attached to the TED by two support rods. The maximum clearance between the roller and the TED shall not exceed 1 inch (2.5 cm) at the center of the roller. The support rods and axle rod must be made from solid steel or solid aluminum rod no larger than1/2inch (1.28 cm) in diameter. The attachment of the support rods to the TED shall be such that there are no protrusions (lips, sharp edges, burrs, etc.) on the front face of the grid. The axle rod and support rods must lie entirely behind the plane of the face of the TED grid.

(ii) A single roller consisting of hard plastic tubing shall be tightly tied to the back face of the TED grid with rope or heavy twine passed through the center of the roller tubing. The roller shall lie flush against the TED. The maximum outside diameter of the roller shall be 31/2inches (8.0 cm), the minimum outside diameter of the roller shall be 2 inches (5.1 cm), and the maximum length of the roller shall be 12 inches (30.4 cm). The roller must lie entirely behind the plane of the face of the grid.

(6) *Water deflector fin for hooped hard TEDs.* On a hooped hard TED, a water deflector fin may be welded to the forward edge of the escape opening. The fin must be constructed of a flat aluminum bar, up to 3/8 inch (0.95 cm) thick and up to 4 inches (10.2 cm) deep. The fin may be as wide as the width of the escape opening, minus 1 inch (2.5 cm). The fin must project aft into the TED with an angle between 5° and 45° from the normal, horizontal plane of the trawl. On an inshore hooped hard TED, the clearance between the deflector bars and the posterior edge of the deflector fin must be at least 20 inches (51 cm). On an offshore hooped hard TED, the clearance between the deflector bars and the posterior edge of the deflector fin must be at least 23–1/4 inches (59 cm).

(7) *Hinged door frame for hooped hard TEDs.* A hinged door frame may be attached to the forward edge of the escape opening on a hooped hard TED. The door frame must be constructed of materials specified at paragraphs (a)(1)(i) or (a)(1)(ii) of this section for inshore and offshore hooped hard TEDs, respectively. The door frame may be covered with a single panel of mesh webbing that is taut and securely attached with twine to the perimeter of the door frame, with a mesh size not greater than that used for the TED extension webbing. The door frame must be at least as wide as the TED escape opening. The door frame may be a maximum of 24 inches (61 cm) long. The door frame must be connected to the forward edge of the escape opening by a hinge device that allows the door to open outwards freely. The posterior edge of the door frame, in the closed position, must lie at least 12 inches (30 cm) forward of the posterior edge of the escape opening. A water deflector fin may be welded to the posterior edge of the hinged door frame. The fin must be constructed of a flat aluminum bar, up to 3/8 inch (0.95 cm) thick and up to four inches (10.2 cm) deep. The fin may be as wide as the width of the escape opening, minus one inch (2.5 cm). The fin must project aft into the TED with an angle between 5° and 45° from the normal, horizontal plane of the trawl, when the door is in the closed position. The clearance between the posterior edge of the escape opening and the posterior edge of the door frame or the

posterior edge of the water deflector fin, if installed, must be no less than 12 inches (30 cm), when the door is in the closed position. Two stopper ropes or a hinge limiter may be used to limit the maximum opening height of the hinged door frame, as long as they do not obstruct the escape opening in any way or restrict the free movement of the door to its fully open position. When the door is in its fully open position, the minimum clearance between any part of the deflector bars and any part of the door, including a water deflector fin if installed, must be at least 20 inches (51 cm) for an inshore hooped hard TED and at least 23 1/4 inches (59 cm) for an offshore hooped hard TED. The hinged door frame may not be used in combination with a webbing flap specified at paragraph (d)(3) of this section or with a water deflection fin specified at paragraph (d)(6) of this section.

(e) *Revision of generic design criteria, and approval of TEDs, of allowable modifications of hard TEDs, and of special hard TEDs.* (1) The Assistant Administrator may revise the generic design criteria for hard TEDs set forth in paragraph (a) of this section, may approve special hard TEDs in addition to those listed in paragraph (b) of this section, may approve allowable modifications to hard TEDs in addition to those authorized in paragraph (d) of this section, or may approve other TEDs, by regulatory amendment, if, according to a NMFS-approved scientific protocol, the TED demonstrates a sea turtle exclusion rate of 97 percent or greater (or an equivalent exclusion rate). Two such protocols have been published by NMFS (52 FR 24262, June 29, 1987; and 55 FR 41092, October 9, 1990) and will be used only for testing relating to hard TED designs. Testing under any protocol must be conducted under the supervision of the Assistant Administrator, and shall be subject to all such conditions and restrictions as the Assistant Administrator deems appropriate. Any person wishing to participate in such testing should contact the Director, Southeast Fisheries Science Center, NMFS, 75 Virginia Beach Dr., Miami, FL 33149–1003.

(2) Upon application, the Assistant Administrator may issue permits, subject to such conditions and restrictions as the Assistant Administrator deems appropriate, authorizing public or private experimentation aimed at improving shrimp retention efficiency of existing approved TEDs and at developing additional TEDs, or conducting fishery research, that would otherwise be subject to §223.206(d)(2). Applications should be made to the Southeast Regional Administrator (see §222.102 definition of “Southeast Regional Administrator”).

[64 FR 14073, Mar. 23, 1999, as amended at 64 FR 55438, Oct. 13, 1999; 66 FR 1603, Jan. 9, 2001; 66 FR 24288, May 14, 2001; 68 FR 8467, Feb. 21, 2003; 68 FR 51514, Aug. 27, 2003; 68 FR 54934, Sept. 19, 2003; 69 FR 31037, June 2, 2004]

Effective Date Note: At 64 FR 14073, Mar. 23, 1999, §223.207 was added. Paragraphs (a)(9)(ii) (A) and (B) contain information collection and recordkeeping requirements and will not become effective until approval has been given by the Office of Management and Budget.

§ 224.104 Special requirements for fishing activities to protect endangered sea turtles.

(a) Shrimp fishermen in the southeastern United States and the Gulf of Mexico who comply with rules for threatened sea turtles specified in §223.206 of this chapter will not be subject to civil penalties under the Act for incidental captures of endangered sea turtles by shrimp trawl gear.

. . .

(c) Special prohibitions relating to sea turtles are provided at §223.206(d).

[64 FR 14066, Mar. 23, 1999, as amended at 66 FR 44552, Aug. 24, 2001; 66 FR 67496, Dec. 31, 2001; 68 FR 8471, Feb. 21, 2003; 69 FR 18453, Apr. 7, 2004; 72 FR 31757, June 8, 2007]

Appendix 3: Anticipated Incidental Take of ESA-Listed Species in NMFS-Authorized Federal Fisheries in the Southeast Region

Table A.1. Fishery Incidental Take Authorized in the Southeast Region

<table>
<tr><th rowspan="2">Fishery</th><th rowspan="2">ITS Authorization Period</th><th colspan="6">Listed Species</th></tr>
<tr><th>Loggerhead</th><th>Leatherback</th><th>Kemp’s Ridley</th><th>Green</th><th>Hawksbill</th><th>Smalltooth Sawfish</th></tr>
<tr><td>Coastal Migratory Pelagics</td><td>3-Year</td><td>33-All lethal</td><td colspan="2">2 lethal takes for Leatherbacks, Hawksbill, and Kemp’s Ridley-both lethal take</td><td>14-All Lethal</td><td>See leatherback entry</td><td>2 Non-lethal Takes</td></tr>
<tr><td>Dolphin-Wahoo</td><td>1-Year</td><td>12-No more than 2 lethal</td><td>12-No more than 1 lethal</td><td colspan="3">3 for all species in combination-no more than 1 lethal take</td><td>None</td></tr>
<tr><td>Gulf of Mexico Reef Fish</td><td>3-Year</td><td>1,044-No more than 572 lethal</td><td>11-All lethal</td><td>108-No more than 41 lethal</td><td>116-No more than 75 lethal</td><td>9-No more than 8 lethal</td><td>8 Non-lethal Takes</td></tr>
<tr><td>HMS-Pelagic Longline</td><td>3-Year</td><td>1,905-No more than 339 lethal</td><td>1,764-No more than 252 lethal</td><td colspan="3">105-No more than 18 lethal for these species in combination</td><td>None</td></tr>
<tr><td>HMS-Shark</td><td>3-Year</td><td>679-No more than 346 lethal</td><td>74-No more than 47 lethal</td><td>2 – No more than 1 lethal</td><td>2 – No more than 1 lethal</td><td>2 – No more than 1 lethal</td><td>51–No more than 1 lethal take</td></tr>
<tr><td>Gulf of Mexico and South Atlantic Spiny Lobster</td><td>3-Year</td><td>3-Lethal or Non-Lethal Take</td><td colspan="2">1 –Lethal or Non-Lethal take for Leatherbacks, Hawksbill, and Kemp’s Ridley</td><td>3-Lethal or Non-Lethal Take</td><td>1 –Lethal or Non-Lethal take for Leatherbacks, Hawksbill, and Kemp’s Ridley</td><td>2 Non-lethal Takes</td></tr>
<tr><td>South Atlantic Snapper-Grouper</td><td>3-Year</td><td>202-No more than 67 lethal</td><td>25-No more than 15 lethal</td><td>19-No more than 8 lethal</td><td>39-No more than 14 lethal</td><td>4-No more than 1 lethal</td><td>8 Non-lethal Takes</td></tr>
</table>

Appendix 4: Summary of TED Education, Training, and Outreach Conducted by NMFS Since 2003

YEAR	MONTH	Lead	LOCATION	PURPOSE	Participating Groups	No. of Events
2003	March	SEFSC	Charleston, SC & Brunswick, GA	State LE Training	SCDNR, GADNR, USCG SERFTEC, NOAA OLE	1
2003	Sept	SEFSC	Tampa, FL	GSAFF TED and BRD Workshop, Review large opening requirement, and results from shrimp retention studies	Industry Leaders	1
2003	Feb	SEFSC	New Bern, NC	NC Fishermen's Trade Show / Large TED opening displays	Industry	1
2003	March	GSAFF w SEFSC	NC, SC & GA Ports	Large TED Opening Workshops	Industry	(NC 16, SC 9, GA 7)
2003	April	HQ/SERO/SEFSC	Galveston, TX	New TED rule overview at Sea Grant Conf.	Industry & Management	1
2003	April	GSAFF w SEFSC	Florida East Coast Ports	Large TED Opening Workshops	Industry	4
2003	April	SEFSC	NC net shops and ports	Large Opening Outreach	Industry	19
2003	April	SEFSC	LA	Survey of grid sizes	Fact finding	multiple
2003	April	SEFSC	LA Ports	Dockside and net shop visits	Industry	3

2003	May	GSAFF w SEFSC	Florida West Coast Ports	Large TED Opening Workshops	Industry	3
2003	May	SEFSC	Galveston, Corpus Christi & Baytown, TX	TP&W TEDs training	LE training	3
2003	May	SEFSC	St. Augustine, FL	FWCC TEDs training	LE training	1
2003	May	SEFSC	Key West, FL	USCG TEDs training	LE training	1
2003	June	GSAFF w SEFSC	Texas Ports	Large TED Opening Workshops	Industry	9
2003	June	SEFSC	Panama City, FL	New TED and modification testing	Research w/industry	
2003	June	GSAFF w SEFSC	Florida West Coast Ports	Large TED Opening Workshops	Industry	2
2003	July	GSAFF w SEFSC	Central Gulf	Large TED Opening Workshops	Industry	AL 2, MS 1, LA 1
2003	Aug	SEFSC	Biloxi, MS	Dockside courtesy checks	Industry	1
2003	Aug	SEFSC/SERO/HQ	Houston, TX	meeting to discuss problems w new TED openings	Industry (TSA)	1
2003	Sept	SEFSC	Biloxi, MS	TED workshop	Industry	1

2003	Mar-April	SEFSC	Eastern LA	Net shop instruction & Vietnamese fisher workshops	Industry	6
2003	August	SEFSC	Houma, LA	Fisher meeting w/SERO AA & Hogarth	Industry	1
2003	Aug-Dec	SEFSC	Gulf-Wide	Distribution of Free TEDs (700)	Industry	multiple
2004	Feb	SEFSC	Cameron, LA	TED workshop for fishers	Industry	1
2004	Feb	SEFSC	Brunswick, GA	Wild turtle testing of 24-in DC flap	Sea Grant	1
2004	March	SEFSC	SC and GA	TEDs training for SCDNR and GADNR	LE training	2
2004	June	SEFSC	Panama City, FL	New TED and modification testing	Research w/industry	1
2004	July	SEFSC	Pascagoula, MS	Dockside visit to improve shrimp catch	Industry	1
2004	July	SEFSC & OLE	Corpus Christi, TX	10 day tech. assist to OLE during TX opening	LE training /assist	multiple
2004	Sept	SEFSC	AL	post-storm debris survey and TED problems	Fact finding	1
2004	Sept	SEFSC	Palacios, TX	TED testing to improve inshore TED perf. for shrimp	Research w/industry	1

2004	Oct	SEFSC	Hoebucken, NC	Fisher outreach	Industry	1
2004	Nov	SEFSC	Brunswick, GA	Wild turtle testing of Boone TED	Research w/industry	1
2005	March	SEFSC	Point Clear, AL	TEDs Update to Sea Grant Extension Agents	Sea Grant Extension	1
2005	April	SEFSC	Brownsville, TX	TEDs workshop for fishers	Industry & TP&W	1
2005	May	SEFSC	Brunswick, GA	TEDs Training w/USCG	LE Training	1
2005	May	SEFSC	Chauvin, LA	Support to GSAFF Optimum TEDs Study	Research w/industry	1
2005	May	SEFSC	Key West, FL	TEDs training for USCG and FWCC Officers	LE Training	1
2005	June	SEFSC, OLE, MSDMR	Pascagoula, MS	Tech. assist to NOAA OLE TED inspections	LE training	1
2005	June	SEFSC	Panama City, FL	New TED and modification testing	Research w/industry	1
2005	July	SEFSC, OLE	Texas Coast	Tech. assist to NOAA OLE TED inspections	LE Training	multiple
2005	all-year	SEFSC,GSAFF	Gulf	GSAFF optimal TED study with industry	Research w/industry	multiple

2006	May	SEFSC	MS Sound	Debris Survey for TED exemptions	Fact Finding	1
2006	May	SEFSC	Galveston, TX	NMFS Observer training	NMFS Observer Program	1
2006	June	SEFSC	MS Sound	Debris Survey for TED exemptions	Fact Finding	1
2006	June	SEFSC	Dauphin Island AL	LE Training w/AL Marine Patrol	LE Training	1
2006	June	SEFSC	Panama City, FL	New TED and modification testing	Research w/industry	1
2006	June	SEFSC	Charleston, SC	LE Training for USCG SERFTEC	LE Training USCG	1
2006	July	SERO	St. Petersburg, FL	VMS scoping meeting	SERO meeting	1
2006	Oct	SEFSC	Galveston, TX	TP&W LE training	LE training	1
2006	Dec	SEFSC	Port Arthur, TX	TEDs inspection for NOAA GC	NOAA GC	1
2007	July	SEFSC	Texas Coast	Tech. assist to NOAA OLE TED inspections	LE training	multiple
2007	April	SEFSC	Golden Meadow, LA	Net Shop Visits	Industry	2
2007	June	SEFSC	Panama City, FL	New TED and modification testing	Research w/industry	1
2007	July	SEFSC	Texas Coast	Tech. assist to NOAA OLE TED inspections	LE Training	multiple

2008	April	SEFSC	Empire &Venice, LA	TED & BRD Outreach	Industry Outreach	2
2008	April	SEFSC	Florida Panhandle	LE Training and Industry Outreach	LE and industry	2
2008	April	SEFSC	Charleston, SC	LE Training for SCDNR and USCG SERFTEC	LE Training	1
2008	June	SEFSC	Panama City, FL	New TED and modification testing	Research w/industry	1
2008	June	SEFSC	St. Augustine, Mayport, FL	LE Training NOAA OLE & FWCC	LE Training	1
2008	Oct	SEFSC	Western LA	Hurricane debris survey	w/NOAA OLE and industry	2
2008	Nov	SEFSC	Wanchese, NC	TED workshop for fishers	Industry Outreach	1
2008	Dec	SEFSC	Ponce Inlet, FL	USCG TEDs Training	LE Training USCG	1
2008	Year-long	GSAFF	Gulf & S. Atlantic	TEDs Outreach Project (MARFIN)	Industry Outreach	multiple
2009	March	SEFSC	Tallahassee, FL	FWCC TEDs training	LE Training FWCC	1
2009	May	SEFSC	Galveston, TX	TP&W & USCG TEDs training at-sea	LE at-sea training & Assistance	2
2009	June	SEFSC	Morehead City & Wanchese, NC	LE Training and Fisher outreach	Industry and NCDMF LE	2

2009	June	SEFSC	Panama City, FL	New TED and modification testing	Research w/industry	1
2009	July	SEFSC & OLE	MS Sound	At-sea assistance to OLE	LE training and assistance	1
2009	July	SEFSC & OLE	Texas Coast & LA	At-sea assistance to TP&W & OLE	LE training and assistance	multiple
2009	Oct	SEFSC	Tallahassee, FL	LE training for TEDs and Hook and line release FWCC	LE Training and assistance	1
2009	June	SEFSC	Panama City, FL	New TED and modification testing	Research w/industry	1
2009	Year-long	GSAFF	Gulf & S. Atlantic	TEDs Outreach Project (MARFIN)	Industry Outreach	multiple
2010	June	SEFSC	Panama City, FL	New TED and modification testing	Research w/industry	1
2010	July	SEFSC	Bayou La Batre, AL	Oil Skimmer evaluation	DWH response	1
2010	July	SEFSC	Galveston, TX	Fisher Workshop with TP&W	Fisher workshop	1
2010	July	SEFSC	Galveston, TX	LE Training and assistance; Texas Opening	TP&W LE assistance	1
2010	July	SEFSC	Mobile Bay, AL	LE Training and assistance:TED inspections	ALDNR LE assistance	1
2010	Aug	SEFSC	Western LA	Survey of TED compliance; courtesy inspections	Fact finding/ GMT courtesy inspections	multiple

2010	Aug	SEFSC	Port Lavaca, TX	TP&W TED and BRD training; TED inspections	LE Training for TP&W	2
2010	Oct	SEFSC	Tallahassee, FL	FWCC TED and hook and line turtle release training	LE training for FWCC	1
2010	Dec	SEFSC&SERO	Mayport & Ft. Meyers, FL	Compliance survey; courtesy inspections	GMT courtesy inspections	2
2010	Year-long	GSAFF	Gulf & S. Atlantic	TEDs Outreach Project (MARFIN)	Industry Outreach	multiple
2011	March	SEFSC	Charleston, SC	Hook and Line turtle outreach	Industry outreach/ Blue Water Fishers Assoc.	1
2011	Jan	SEFSC	Galveston, TX	TP&W LE training	LE training	1
2011	Feb	SEFSC	Mayport, FL	Fisher workshop TEDs	Industry outreach	1
2011	March	SEFSC,OLE& GC	St. Petersburg, FL	Meeting to discuss revisions to penalty sched.	Internal meeting	1
2011	March	SEFSC	MS Sound	Shrimping activity survey	Fact finding	1
2011	April	SEFSC	Western LA (Lake Charles)	Courtesy TED inspections	GMT Courtesy TED inspections	multiple
2011	April	SEFSC & OLE	Venice, LA	Fisher workshop; TEDs	GMT & OLE workshop	1

2011	April	SEFSC	MS Sound (Gulfport Channel)	Dredge survey in response to strandings	Fact finding	1
2011	April	SEFSC & OLE	Biloxi, MS	Dockside courtesy inspections	GMT & OLE courtesy inspections	multiple
2011	April	SEFSC & OLE	Alabama waters	Compliance inspections offshore	GMT & OLE compliance inspections	multiple
2011	May	SEFSC	Biloxi, MS	Fisher workshop on TED compliance	industry outreach	1
2011	May	SEFSC	Biloxi, MS (DMR Office)	Fisher workshop on TED compliance	industry outreach	1
2011	June	SEFSC, Sea Grant and TP&W	Texas coast	Fisher workshops on TED regulations	industry outreach	4
				and hook and line requirements		4
2011	June	SEFSC	Morehead City, NC	Meeting with NCDMF on TED requirements	LE training	1
2011	June	SEFSC & OLE	Western LA (Lake Charles)	Compliance inspections offshore	Compliance Inspections with OLE	1
2011	June	SEFSC & OLE	Port Arthur, TX	Courtesy TED inspections	TED inspections with OLE	1

Appendix 5: Method and Code Used To Calculate the Atlantic Effort Data 2001-2009

Input data sets used:

FL 2001-2009 - Florida Trip Ticket (FTT) data housed in the FTT database at SEFSC.
NC 2001-2009 - NC trip ticket data housed at Atlantic Coastal Cooperative Statistics Program (ACCSP) data warehouse.
SC 2001-2005 – SC detailed shrimp data housed in the South Atlantic Shrimp (SAS) database.
SC 2006-2009 – SC trip ticket data housed at Atlantic Coastal Cooperative Statistics Program (ACCSP) data warehouse.
GA 2001-2005 – SC detailed shrimp data housed in the South Atlantic Shrimp (SAS) database.
GA 2006-2009 – SC trip ticket data housed at Atlantic Coastal Cooperative Statistics Program (ACCSP) data warehouse.
AL, MS, LA, TX 2001-2009 –Trip ticket data housed in the GulfFIN database.

Data from ACCSP require joining data from multiple tables. The DEALER REPORTS table has information on vessel, dealer, port of landing, date of landing and area fished. The LANDINGS table has information on species, condition, market category, pounds landed and value. For those trip ticket programs that collect detailed effort information above what is collected in the dealer report table, these data reside in the TRIPS, EFFORTS and CATCHES tables. The TRIPS table has data on the date sailed, number of trips, split trip or not, days at sea, number of crew and port of landing. The EFFORTS table records information on the fishing area, distance from shore, gear used, gear quantity, gear sets, fishing hours and soak time. The CATCHES table records data species caught, landed pounds, disposition, unit of measurement (pounds, numbers, bushels, etc.), market, grade and value.

The TRIPS table was updated with information from EFFORTS and CATCHES table to assign the predominant area fished and distance from shore based on the pounds landed from each area within a trip. Predominant gear used was then assigned, also using pounds landed. Gear quantity, gear sets and fishing hours were then updated using the maximum values for each trip. Disposition was then used to determine the primary disposition (Food or Bait) for the catch from that trip based on the pounds landed. The predominant species in the catch was then assigned based on the pounds landed. A base table was created with data from the DEALER REPORTS and LANDINGS tables, including: trip identifier, data supplier (state agency), unload date, state of landing, county of landing, dealer, vessel, gear, area fished, distance from shore, pounds landed and value. This table was then updated from the TRIPS table with the highest recorded number of trips and predominant species from the trip table for each dealer report (trip id).

Florida trip ticket data were coded to FIN standard codes and inserted into the base table from the FTT_TYPE1 table, which includes the trip data (dealer, vessel, date sailed, date landed, gear, area fished, time fished) joined to the FTT_TYPE3 table and FTT_TYPE3_FIXED tables, which include the detailed information on gear, area fished county landed, disposition, grade, pounds landed and value for each species. The FTT data was then updated with the predominant gear, species, disposition, county of landing and fishing area.

Data from the SAS system were then extracted to a temporary table and individual records identified by dealer, vessel, date of landing, state, county and schedule number. This was necessary because the SAS_MAIN_DATA table is a flat file, with a record for each species caught during the trip, creating multiple lines of data from each trip. Predominant species, disposition, gear and fishing area where assigned based on pounds landed and the number of trips was assigned based on the maximum number of trips for each record. These data were then coded to match the code structure from ACCSP and added to the base table holding the ACCSP and FTT data. This may be different than previous method used; resulting in more accurate estimate of trips (previous report may have overestimated trips).

Data from GulfFIN for AL, MS, LA and TX, where shrimp trips were identified as fishing in the Atlantic were then added to the base table from the DEALER_REPORTS and LANDINGS tables at GulfFIN.

All data was then reformatted to ensure all the formats in each variable are consistent for each dataset added to the base table. Gears, trips, disposition, distance from shore, start date and areas fished were then updated from the ACCSP TRIPS table and shrimp season and shrimp area were assigned. Data were then summarized by state, county, vessel, start data, unload date, gear, area, trips, days fished, pounds landed and value.

Days fished were then calculated by state:

FL:

- If TIME_UNITS indicated hours, but TIME_FISHED was less than UNLOAD DATE-START DATE the TIME_FISHED was treated as days, while if the TIME_UNIT indicated days but TIME_FISHED was greater than UNLOAD DATE-START DATE, TIME_FISHED was treated as hours.

- If TIME_UNITS was hours, DAYS_FISHED was recalculated as 1+trunc((TIME_FISHED - 12)/12). (Note that an error was found in the original code that was used to generate effort in the 2002 report. The bias was to underestimate days fished by 1 day in a proportion of the trips.)

- If TIME_UNITS was in days, DAYS_FISHED was set = TIME_FISHED.

GA:

- DAYS_FISHED was set equal to DAYS_FISHED recorded in the data. Where DAYS_FISHED was missing, it was set equal to number of trips x UNLOAD

DATE-START DATE (i.e., a trip is one day) if UNLOAD DATE=START DATE then DAYS_FISHED = trips.

NC:

- Where DAYS_FISHED was missing, it was set equal to number of trips x UNLOAD DATE-START DATE (i.e., a trip is one day) if UNLOAD DATE=START DATE then DAYS_FISHED = trips.

SC:

- If season was "SUMMER" and fishing location was in the ocean then DAYS_FISHED = 2.5x trips.

- If season was "WINTER" and fishing location was in the ocean then DAYS_FISHED = 2.3x trips.

- If the location was inshore then DAYS_FISHED was set equal to the number of trips.

  Note that in the original 2002 report, days fished was based on reported trips in 2001 and trip duration information from 1989-1990.

ALL STATES:

For all trips greater than 45 days fishing, the DAYS_FISHED were considered erroneous and the DAYS_FISHED was set to missing. Any trips still missing DAYS_FISHED because days fishing were not recorded or START DATE was not recorded or DAYS_FISHED was greater than 45 days where estimated from the average DAYS_FISHED for the same year, season, distance from shore and data supplier. AL had no average (data did not include days fishing or date sailed), so the DAYS_FISHED was set equal to the number of trips.