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 under the ESA and the Continued Authorization of the Southeast U.S. Shrimp Fisheries in Federal Waters under the Magnuson-Stevens Fishery Management and Conservation Act (MSFMCA)

Consultation No. SER-2013-12255

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

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List of Frequently Used Acronyms

ASMFC	Atlantic States Marine Fisheries Commission
CCL	Curved Carapace Length
USACE	United States Army Corps of Engineers
CPUE	Catch Per Unit Effort
DPS	Distinct Population Segment
DWH	Deepwater Horizon
EFP	Exempted Fishing Permit
EEZ	Exclusive Economic Zone
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
F/SER2	Southeast Regional Office Sustainable Fisheries Division
F/SER3	Southeast Regional Office Protected Resources Division
FMP	Fishery Management Plan
GMFMC	Gulf of Mexico Fishery Management Council
GMT	SEFSC Gear Monitoring Team
ITS	Incidental Take Statement
MMPA	Marine Mammal Protection Act of 1972
MSFCA	Magnuson-Stevens Fishery Conservation and Management Act
NOAA	National Oceanic and Atmospheric Administration
NMFS	National Marine Fisheries Service
NSED	National Sawfish Encounter Database
OLE	NMFS Office of Law Enforcement
RPAs	Reasonable and Prudent Alternatives
RPMs	Reasonable and Prudent Measures
SCL	Straight Carapace Length
SAFMC	South Atlantic Fishery Management Council
SEFSC	Southeast Fisheries Science Center
SERO	Southeast Regional Office
STSSN	Sea Turtle Stranding and Salvage Network
TEDs	Turtle Excluder Devices
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USN	United States Navy

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 that 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. To fulfill this obligation, Section 7(a)(2) requires federal agencies to consult with the appropriate Secretary on any action they propose that "may affect" listed species or designated critical habitat. The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) share responsibilities for administering the ESA.

A federal action agency requests consultation when it determines that a proposed action "may affect" listed species or designated critical habitat. Consultations on most listed marine species and their designated critical habitat are conducted between the action agency and NMFS. The consultation is 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) that identifies whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its critical habitat. If either of those circumstances is expected, the opinion identifies reasonable and prudent alternatives (RPAs) to the action as proposed, if any, that can avoid jeopardizing listed species or resulting in the destruction/adverse modification of critical habitat. The opinion states the amount or extent of incidental take of the listed species that may occur, specifies reasonable and prudent measures (RPMs) that are required to minimize the impacts of incidental take and monitoring to validate the expected effects of the action, and recommends conservation measures to further conserve the species.

This document represents NMFS's 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 (MSFCA) (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 1996; NMFS 1996b; NMFS 1998; NMFS 2002b; NMFS 2005e; NMFS 2006b; NMFS 2012c)]. 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 opinion concluded that the regulations would substantially reduce sea turtle mortalities. At that time, NMFS's 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 United States, 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 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 1996). NMFS had reinitiated consultation 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 2002b). 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 and Teas 2002; Epperly et al. 1999) 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 (2002b) 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% for loggerheads and 97% 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 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 2005e). 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 2006b). 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's continued authorization of the fishery.

On May 8, 2012, NMFS completed a Section 7 consultation and issued an opinion on the continued implementation of the sea turtle conservation regulations applicable to shrimp trawling, as then proposed to be amended, and the continued authorization of Southeast U.S. shrimp fisheries in federal waters on threatened and endangered species and designated critical habitat (NMFS 2012). The consultation was the result of several requests for reinitiation of consultation on different shrimp fisheries and listed species as various triggers for reinitiation were met. Ultimately, the consultation addressed (1) new observer data indicating that the incidental take levels of smalltooth sawfish in South Atlantic federal shrimp otter trawls and Gulf of Mexico federal shrimp otter trawls had both been exceeded and that the federal Gulf of Mexico shrimp otter trawl fishery had unanticipated adverse effects on Gulf sturgeon; (2) 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), collectively indicating 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; (3) new information on compliance with the TED regulations and on how noncompliance impacted the number of sea turtles captured and killed in shrimp otter trawls; (3) an attempt 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; (4) a proposal to require skimmer trawls, pusher-head trawls, and wing nets (butterfly trawls) to use TEDs; and (5) the February 6, 2012, listing of five distinct population segments (DPSs) of the Atlantic sturgeon under the ESA as endangered (76 FR 59) that may be adversely affected by South Atlantic federal shrimp otter trawls. The opinion (hereafter referred to as the 2012 opinion or (NMFS)) concluded that the proposed action was not likely to jeopardize the continued existence of listed sea turtles, sturgeon, or sawfish. Other listed species and critical habitats in the action area were found either not likely to be adversely affected (i.e., blue, sei, sperm, fin, humpback, and North Atlantic right whales; shortnose sturgeon; elkhorn and staghorn corals; Gulf sturgeon critical habitat and elkhorn and staghorn coral critical habitats) or not to be affected (i.e., Johnson sea grass, North Atlantic right whales, smalltooth sawfish critical habitat, and Johnson sea grass critical habitat).

C*ause 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.

The proposed action of the 2012 opinion included implementation of a final rule requiring TEDs in skimmer trawls, pusher-head trawls, and wing nets. On November 21, 2012, NMFS determined that a final rule requiring such was not warranted at that time and withdrew the proposal. The decision to not implement the final rule created a change to the proposed action analyzed in the 2012 opinion, with effects to listed species that have not previously been considered, thus triggered the need to reinitiate consultation. Consequently, on November 26, 2012, via a memorandum from the Southeast Regional Administrator to the File, NMFS reinitiated consultation. In that same memorandum, NMFS determined that the proposed action in the interim period between the reinitiation of consultation and the completion of a new biological opinion would not jeopardize the continued existence of any species of sea turtles or sturgeon or the smalltooth sawfish.

The present opinion supersedes the 2012 opinion and fulfills NMFS's Section 7 consultation responsibilities on both its continued implementation of the existing sea turtle conservation regulations under the ESA, and its authorization of federal shrimp trawling under the MSFCA for all listed species. New effects analyses contained within are primarily related to the effects that skimmer trawls, pusher-head trawls, and wing nets are expected to have on sea turtles and are based on the withdrawal of the TED requirement for these gear types and the new observer data that led to that change. We have also revisited our sea turtle otter trawl effects analysis to incorporate more recent effort and TED compliance data. The extended consultation period reflects incorporation of over one full year of new TED compliance data (i.e., June 2012 through October 2013). There was relatively little additional new information to incorporate and to consider for other gear types and for individual species. Most of the information in the 2012 opinion remains the best available information on which to estimate the effects of the proposed action. Thus, much of the information from the 2012 opinion is either repeated verbatim within or summarized and incorporated by reference. We have rewritten our Status of the Species sections, but only to improve their clarity and content; the substantive biological information on and the life history, status, and trends of each species is largely unchanged, with the exception of loggerhead sea turtle nesting trend updates.

2.0 Description of the Proposed Action and Action Area

NMFS is proposing to continue to (1) 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) authorize shrimp trawling in the Exclusive Economic Zone (EEZ) under the South Atlantic and Gulf of Mexico Shrimp FMPs. In this section we describe the sea turtles conservation regulations and Southeast 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%, 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% 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 TEDs are described 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.

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 inches apart; and (2) shrimp trawlers fishing for or possessing royal red shrimp, if royal red shrimp make up at least 90% 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.

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 Estimating and Monitoring TED Compliance and Sea Turtle Capture Rates in Otter Trawls

An important factor in the effectiveness of the sea turtle conservation regulations has always been fleet compliance. The extent and severity of TED violations we believe play a major role in how successful the sea turtle conservation regulations are at conserving sea turtles. Shrimp otter trawls when equipped with TEDs compliant with the sea turtle conservation regulations are 97% effective, meaning they have a 3% sea turtle capture rate (i.e., 3 out of 100 sea turtles entering a trawl are captured). When shrimp trawls are equipped with TEDs that are not installed or maintained properly, TED effectiveness can be reduced and in severe cases (e.g., TED opening sewn shut) completely compromised (i.e., result in a 100% sea turtle capture rate). Because sea turtle interaction rates in shrimp trawls indicate interactions are not nearly as rare as they are in other managed fisheries, lack of compliance, even by a relatively small portion of the fleet, can potentially have dramatic results on overall sea turtle mortality levels, and poor fleet compliance with the sea turtle conservation 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,[1] enforce the sea turtle conservation regulations. Active joint enforcement agreements in all Southeast states except North Carolina[2] provide the mechanism to transfer funds to U.S. state and territorial law enforcement agencies and facilitate enforcement cooperation. Enforcement activities are aided by the SEFSC Gear Monitoring Team (GMT) who provides TED technical training programs for all of these law enforcement officers and frequently participate in enforcement boarding activities. The GMT also conducts extensive training and outreach to shrimp fishermen and TED net shops and conducts courtesy boardings, to maximize positive information exchange with fishermen and to identify and correct technical difficulties in the field (see Appendix 3 for details on GMT activities completed since the last opinion).

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[1] A Louisiana law, passed in 1987, states that Louisiana will not enforce the federal law until the following conditions have been met: (1) more accurate and factual information has been developed to show that shrimpers in Louisiana waters contribute significantly to the mortality of sea turtles, (2) it has been demonstrated that the use of TEDs will appreciably prevent turtle capture in the special conditions which predominate in Louisiana's inshore waters, (3) TEDs have been thoroughly and scientifically tested in Louisiana waters under normal shrimping conditions, (4) TEDs will work efficiently with no loss of shrimp, (5) TEDs will not endanger the life and safety of shrimpers, and (6) the federal government engages in good faith efforts to develop alternative methods to foster sea turtle populations.

[2] North Carolina law enforcement agencies, per the North Carolina state constitution, have no statutory authority to enter into a mutual aid agreement with a federal law enforcement agency.

In preparing the 2012 opinion, we worked extensively with OLE and GMT to gather the best available information on the extent of compliance with these regulations in the past (i.e., 1980s through 2011). Based on that information, which indicated that TED compliance and therefore sea turtle capture rates had fluctuated greatly since first required, we concluded that setting a sea turtle capture rate standard for the otter trawl fleet was essential for TEDs to be effective at minimizing sea turtle mortality in the otter trawl fleet as intended (please see excerpt from Section 5.1.3.2 of the 2012 opinion and Appendix 4, for details on past compliance levels and how we arrived at this conclusion). The purpose of setting the sea turtle capture rate standard was primarily to establish a realistic current standard for what is expected to actually occur in the fisheries, and secondarily to potentially increase overall TED effectiveness in the otter trawl fleet over the long-term. Specifically, we proposed to monitor and ensure compliance with TED regulations at a level that would keep overall average sea turtle catch rates in the shrimp otter trawl fleet at or below 12% of all sea turtle interactions. It is the responsibility of fishermen to comply with the regulations so the shrimp otter trawl fleet can keep its sea turtle capture rate at or below 12%. However, NMFS does aid in this effort with continued outreach and enforcement. The new fleet-wide TED performance standard was based on the average sea turtle capture rate that we estimated was achieved by the Gulf of Mexico shrimp otter trawl fleet during the four-month period of August-November 201l (please see excerpt from Section 5.1.3.2, Appendix 4, for details on these data and how this capture rate was derived.).

By means of the 2012 opinion and its ITS requirements, we established a new management approach and requirements for minimizing sea turtle captures in shrimp otter trawl fisheries by estimating and monitoring the actual performance of shrimp otter trawls in releasing sea turtles. Under that approach and the associated requirements, which became effective June 1, 2012, we review detailed TED inspection boarding data on the type and severity of TED violations every six months to estimate the extent of overall fleet-wide compliance with the shrimp otter trawl TED regulations and associated sea turtle capture rates. If a six-month review indicates that the shrimp otter trawl fleet exceeded the average 12% standard during that time period, we then must initiate a number of actions. These actions include (1) an investigation of the geographic scope of the compliance problem and identification of any discrete areas where non-compliance is occurring; (2) targeted outreach by the GMT in identified problem areas, including training and courtesy inspections and targeted enforcement activity in problem areas; and (3) monthly compliance data analyses to evaluate the effect outreach, training, and enforcement is having on compliance. If, after monitoring sea turtle capture rates in shrimp otter trawls (i.e., via vessel boardings) each month for an additional six months, we find that our actions have not been sufficient to reduce the fleet-wide average sea turtle capture rate below the 12%, we then consider whether using our authority under Section 11(f) of the ESA to close the area or areas where compliance is a problem to shrimp fishing for up to one year is warranted.

In Section 5.1.3.2 of this opinion, we review how we analyze and calculate sea turtle capture rates using TED boarding data, present updated data, and discuss the results of our and the fleets' efforts to maintain an 12% sea turtle capture rate since June 1, 2012. We conclude that we still believe a sea turtle capture rate of 12% is realistic and anticipate the shrimp otter trawl fleet will maintain that rate in the future. Thus, we propose to continue to monitor and ensure compliance with TED regulations at a level that would keep overall average sea turtle catch rates in the shrimp otter trawl fleet at or below 12%.

In this opinion, we are revising and clarifying our TED compliance and sea turtle capture rate review and management process slightly. We will still use six-month average sea turtle capture rates in the future as the primary basis for determining if the shrimp otter trawl fleet is maintaining average sea turtle capture rates at or below our 12% average sea turtle capture rate standard and if any additional actions need to be taken as outlined in the 2012 ITS requirements and repeated above. However, after completion of this opinion we will initiate monthly data reviews routinely rather than only subsequent to six-month data reviews during which the average sea turtle capture rate standard was exceeded. Estimating monthly sea turtle capture rates routinely will help us better track the number and results of boardings and fleet performance and allow us to provide faster and more frequent feedback to industry on how they are doing relative to the sea turtle capture rate standard.

Presently we have no way of testing our assumption that boarding data on TED compliance are representative of the fleet. Enforcement agents conduct boardings at particular times and in particular locations that are not usually random in nature. The logic underlying these decisions can vary depending on the available information (e.g. suspected problem areas, fishing effort data) and the desires of the boarding agents. In the 2012 opinion, based on our discussion with experienced GMT personnel and OLE agents at that time, we concluded we did not believe that 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. We noted that conversely the known presence of OLE in the area could affect the observed local compliance and result in actual higher boarding compliance rates compared to compliance rates of non-boarded vessels. As an example, we pointed out the potential for non-compliant vessels to be forewarned of an inspection patrol, i.e., radio communications between fishers, but such bias cannot be quantified. While that potential does still exist, boardings are not conducted as a randomized sampling program and instead are increasingly focused on efforts to address specific problem areas or intelligence and to effect change. In reconsidering this information and after further discussions with OLE, we believe compliance documented by OLE is much more likely to be less than overall fleet compliance.

Not having random sample of boardings makes it difficult to determine which (if any) areas should be closed for compliance problems. In the 2012 opinion we stated that we would gather TED compliance data from OLE, SEFSC GMT, SEFSC Shrimp Observer Program, USCG, and state enforcement agencies for analysis. So far we have conducted our quantitative compliance reviews using vessel boarding data collected only by NMFS OLE and SEFSC GMT. This is because these are the two data sources for which we can verify the consistency and accuracy of the inspection data. To aid future use of other vessel boarding data sources, we developed a standardized boarding form that can be used and a database that the information can be downloaded to, to ensure standard TED inspection data are collected from all vessel boardings. Another goal is to use future TED observer data in estimating fleet compliance and capture rates because the SEFSC Shrimp Observer Program is designed to collect data representative of the federal fleet. The GMT has been training SEFSC fishery observers on how to measure and record TED data per a 2012 opinion requirement. Prior to using any new data sources, we will develop and publicize a policy for doing such so that the public can be confident in the accuracy and consistency of the data and the manner it is being used.

Our clarification of our TED compliance and sea turtle capture rate review and management process pertains to how we will consider using our authority under Section 11(f) of the ESA to close the area or areas where compliance is a problem to shrimp fishing for up to one year. In considering whether or not to conduct such a rulemaking at all and if so for how long, a number of different factors will be considered, including but not limited to the amount and quality of the underlying compliance data. Our plans to improve the data quality on TED compliance and our ability to verify the data quality will allow us to make more precise decisions on whether or not to implement closures, where they should be implemented, and their duration.

2.2 Southeast Shrimp Fisheries

Southeast shrimp fisheries target different species of shrimp at different stages of their lifecycle using a variety of vessels that range from ocean-going trawlers to small vessels operating in nearshore waters. 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 an 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.[3]

Magnuson et al. (1990) provided an overview of where shrimp effort occurs and how it is distributed within the Southeast: "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]; most of that is in waters shallower than 27 m. The fishing areas off the coastal beaches of Texas and Louisiana account for 55% of the total U.S. effort and 83% of the effort off the coastal beaches. In the Atlantic, 92% is within 5 km of shore. Atlantic shrimping effort is concentrated off South Carolina, Georgia, and northern Florida." While these

[3] 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 online). A panel of experts determined that the stock was overfished due to environmental factors rather than overfishing (NMFS 2009).

statistics are dated, given shrimp production and lifecycles have not changed over the years, this characterization generally still describes Southeast shrimp trawl fisheries today.

In December 2012, NMFS completed a detailed characterization of U.S. Gulf of Mexico and South Atlantic penaeid and rock shrimp fisheries based on July 2007 through December 2010 observer data collected through NMFS's mandatory shrimp observer program (i.e., Scott-Denton et al. [2012]). Scott-Denton et al. (2012) summarized trip, vessel, environmental, and gear characteristics, quantified fish and protected species captures by area and target species, and estimated catch per unit of effort (CPUE) trends and spatial distribution for target and non-target species. Scott-Denton et al. (2012) stated: "The majority of tows (~70%) sampled were off the coasts of Texas and Louisiana. Based on total hours towed, the highest concentrated effort occurred off South Texas and southwestern Florida. Gear information, such as net characteristics, bycatch reduction devices, and turtle excluder devices were fairly consistent among areas and target species."

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 (i.e., chopstick rigs), 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 via its federal FMPs or exempts sea turtle takes from via the sea turtle conservation regulations and that may adversely affect listed species (i.e., otter trawls, skimmer trawls, pusher-head 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-inch to 2-inch. 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.

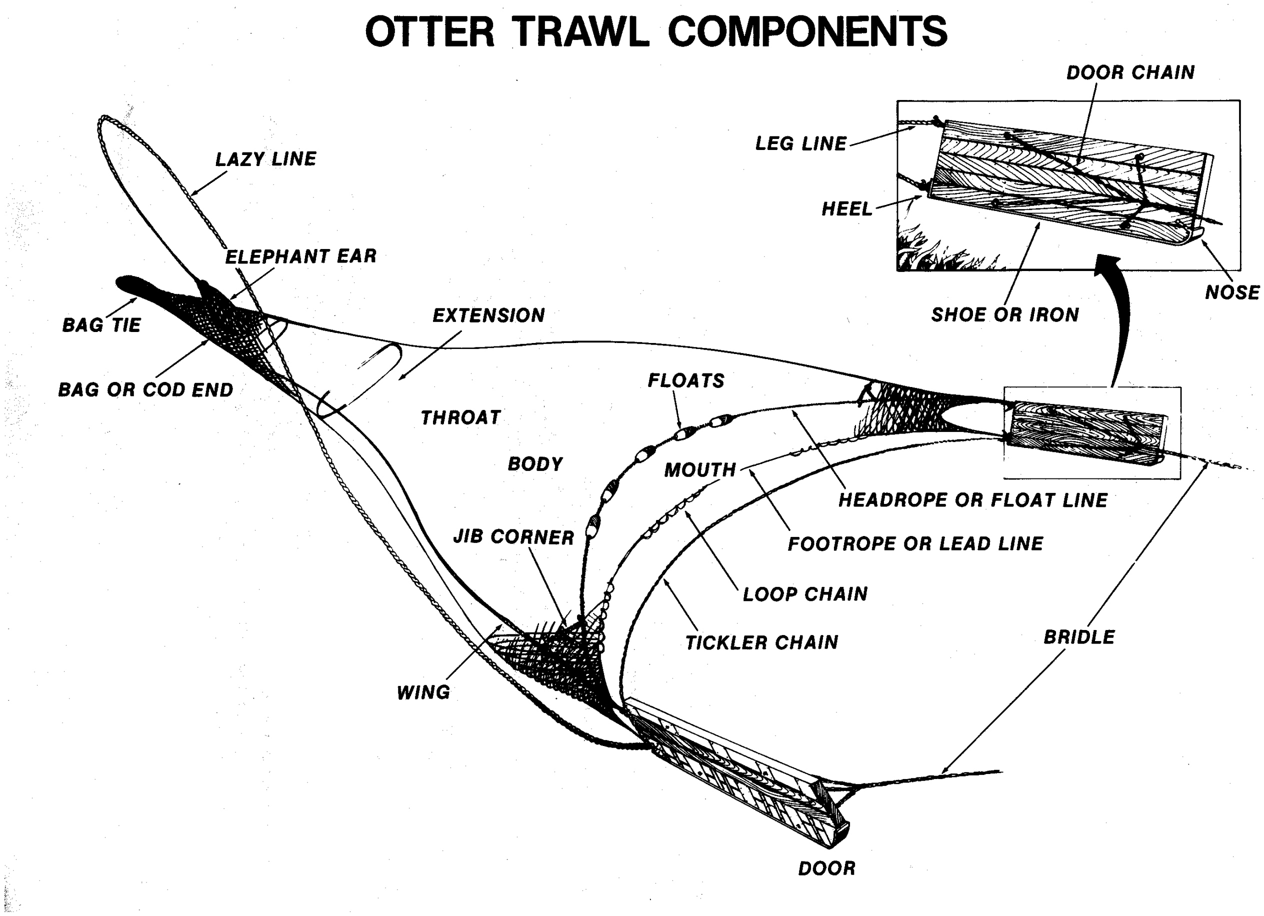

Figure 1. Schematic of an otter trawl and its components.

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. 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 cod end. 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., pusherhead trawls) around 1983. Also known as pusherhead 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. Although the skimmer trawl in Figure 2 is equipped with a bycatch reduction device (BRD) and a TED, neither are required.

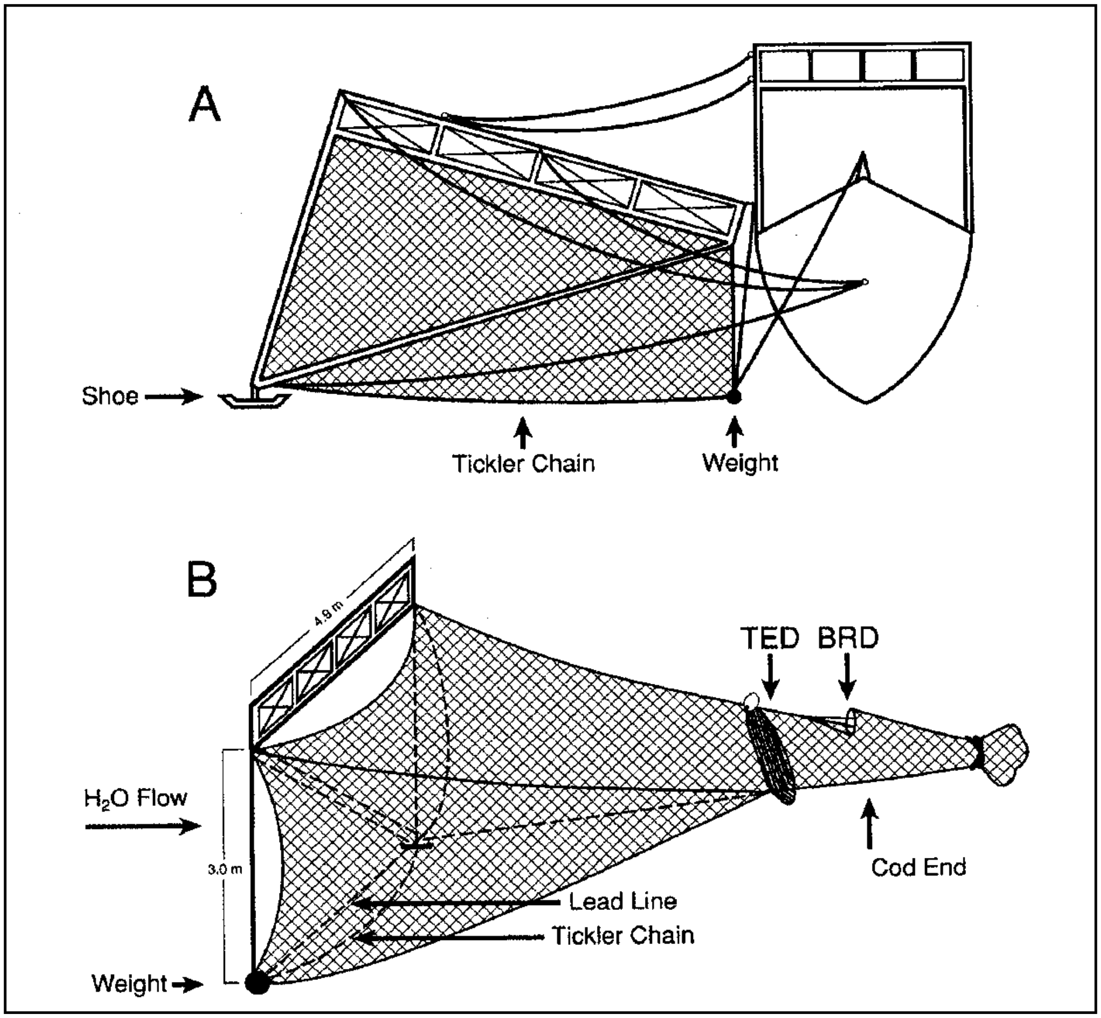

Figure 2. Skimmer trawl diagram showing (A) the skimmer trawl frame viewed from the bow of the vessel and (B) the components of the net, including an installed TED and BRD (from Warner et al. 2004).

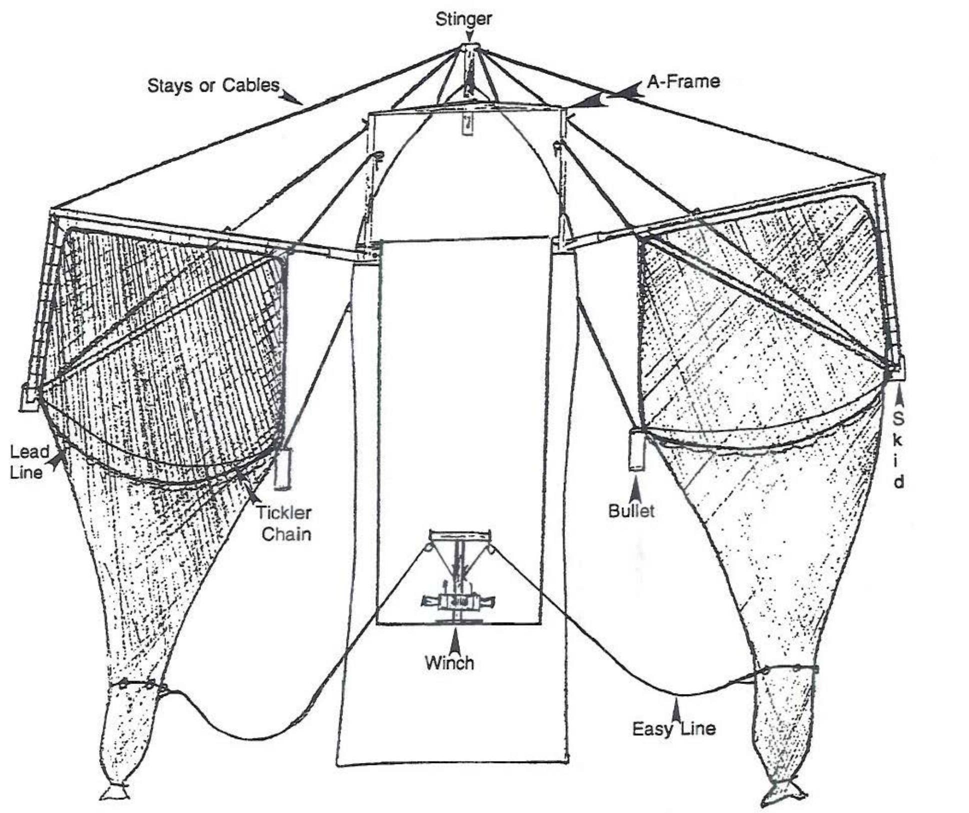

Figure 3. Schematic of a skimmer trawl and its components viewed from overhead (from Hein and Meir 1995).

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. Use of beam trawls in the U.S. Southeast shrimp trawl fisheries is reported only in Texas, where they are an allowable gear for table and bait shrimp in inshore waters only. Their 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 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. 2002b). 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).

Wing nets consist of a pair of "dipnets," each attached to each side of the vessel, that are lowered into the upper water column as the boat powers slowly through schools of shrimp. Vessels targeting shrimp for sale as food use wing net gear to fish the upper water column in or near passes where tidal currents are strong. Fishing is at night, and effort is highest around the full moon when shrimp are concentrated at the surface. Food shrimpers operate around channels, canals, and bridges in Biscayne Bay, Florida. They use 7.6–9.1-m-long skiffs launched from trailers and powered by outboard motors. The best time for shrimping is during strong winds, especially northerners, when shrimp move up into the water column. Wing netters cannot fish in waters shallower than 1.2–1.8 m. Most wing net fishermen operate in mid and upper Biscayne Bay (Johnson et al. 2006).

2.2.2 U.S. Gulf of Mexico Shrimp Fisheries

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. Amendments 9 (GMFMC 2007), 13 (GMFMC and NMFS 2005) and 14 (GMFMC 2007) include a Supplemental EIS updating this information. All of this material is incorporated by reference and is not repeated here in detail. 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 of Mexico 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 1990s 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 MSFCA 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 5, 2013, 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 Fisheries

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

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*) trawling 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 size. 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 MSFCA in federal waters include vessel permits, which are limited access in the Gulf; reporting requirements; mandatory observer coverage, if selected by NMFS; time-area closures to protect juvenile red snapper caught as bycatch; gear restrictions; and requirements to use approved 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. 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.

Regulations at 50 CFR 600.745 allow the NMFS Southeast Regional Administrator to authorize the targeting or incidental harvest of species managed under an FMP or fishing regulations that would otherwise be prohibited for limited testing, public display, data collection, exploratory or compensation fishing, conservation engineering, health and safety surveys, environmental cleanup, hazardous waste removal purposes, or for educational activity. Every year, the SERO may issue a small number of exempted fishing permits (EFPs), and/or exempted educational activity authorizations (EEAA) exempting the collection of a limited number of shrimp from federal waters from regulations implementing the Gulf of Mexico and South Atlantic Shrimp FMPs. Per NMFS policy, SERO may also issue scientific research permits (SRPs) for its own research which might meet the definition of fishing. The EFPs, SRPs, and EEAAs involve fishing by commercial or research vessels, similar or identical to the fishing methods of shrimp fisheries that are the subject of this opinion. In these cases, the types and rates of interactions with listed species from the EFP, SRP, and EEAA activities would be expected to be similar to those analyzed in this opinion. If the fishing type is similar and the associated fishing effort does not represent a significant increase over the effort levels for the overall fishery considered in this opinion, then issuance of some EFPs, SRPs, and EEAAs would be expected to fall within the level of effort and impacts considered in this opinion. For example, issuance of an EFP to an active commercial vessel likely does not add additional effects that would not otherwise accrue from the vessel's normal commercial activities. Similarly, issuance of an EFP, SRP, or EEAA to a vessel to conduct a minimal number of tows with a trawl would not add sufficient fishing effort to produce a detectable change in the overall amount of fishing effort in a given year. Therefore, we consider the issuance of most EFPs, SRPs, and EEAAs by the SERO to be within the scope of this opinion. The included EFPs, SRPs, and EEAAs would be those involving fishing consistent with the description of fishing in Section 2 and which are not expected to increase fishing effort significantly.

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 MSFCA 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 (effective 1982) 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 (effective 1983) updated catch and economic data in the FMP.

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

Amendment 4, 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 1. 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 MSFCA 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 (effective1991) 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 (effective 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 (effective 1995) 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 (effective 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% 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, (effective 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% 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 FMPs of the Gulf of Mexico (effective 1999) identified EFH for 26 species and the coral complex. Using those descriptions as proxies for all remaining species under management was not approved. 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 Gulf of Mexico FMPs (effective 2000) 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 (effective 2004), partially approved on November 2, 2003, required the installation of NMFS-certified BRDs that reduce the bycatch of finfish by at least 30% 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[4] area of Florida were also exempted.

[4] The Big Bend of Florida generally refers to the section of west peninsular Florida's coast without barrier islands—the section from Anclote Key (or the Anclote River), near Tarpon Springs to Ochlockonee Bay, near Alligator Point. Geologists prefer to characterize Florida's Big Bend as the drowned karst section of the coast that occurs between the mouth of the Apalachicola River and Southwest Florida's Central Barrier Coast.

Amendment 11 (effective 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 (part of a generic amendment, effective 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 (effective 2006): (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 (effective 2008) established a target reduction goal for juvenile red snapper mortality of 74% less than the benchmark years of 2001-2003, reducing that target goal to 67% beginning in 2011, and eventually reducing the target to 60% 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 MSFCA by regulations at 50 CFR part 622. The FMP (effective 1993) established stock status criteria (optimum yield [OY] and overfishing for white shrimp and included white shrimp management actions. It also 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). Brown, pink, royal red, and rock shrimp were recognized but not included in the management unit.

Amendment 1 (effective 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 (effective 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 (effective 2000), with a Supplemental EIS, addressed EFH requirements for the species in the management unit.

Amendment 4 (effective 1999), with an Environmental Assessment, addressed Sustainable Fishery Act requirements of the MSFCA, including establishment of stock status thresholds and targets (MSY, OY) as well as rebuilding requirements and bycatch reporting requirements.

Amendment 5 (effective 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 cod end 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 (effective 2006) 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 (effective 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 managed by the GMFMC, SAFMC, or NMFS under the MSFCA.

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

Since 2001, there has been a dramatic decrease in otter trawl effort in southeast U.S. shrimp fisheries. The decline 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).

In the Gulf of Mexico, overall otter trawl effort has declined since 2001. Otter trawl effort steadily declined at a rapid rate from mid-2002 through 2005, with an overall otter trawl effort reduction of 53% during that time frame. Otter trawl effort 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, but effort was still 61% less than it was in 2001. Otter trawl effort was at a record low in 2010. It increased some in 2011 and then declined again in 2012, but not to the record low amount. Both 2011 and 2012 remained below 2009 levels. Given that shrimp otter trawl fisheries still faces many of the other challenges that contributed to the effort declines, otter trawl effort is not expected to increase substantially in the near future.

Otter trawl effort in the South Atlantic has also declined overall since 2001. Between 2002 and 2005 otter trawl effort declined steadily. It rose from 2005 to 2006, staying below 2004 levels, and then declined steadily again through 2009. In 2010, otter trawl effort increased again to a little less than 2006 levels, but in 2011, it declined to a new record low. In 2012, effort bounced back up to just under 2006 levels. Overall otter trawl effort reduction in the South Atlantic between 2002 and 2012 was approximately 44%. There is no data to indicate that otter trawl effort levels will increase in the future from recent levels. Although otter trawl effort from year to year may fluctuate some, it is not expected to increase substantially in the new future.

Table 1. 2001-2012 Shrimp Otter Trawl Effort By Region.

Year	Gulf of Mexico: No. of Days Fished [5]	South Atlantic: No. of Trips[6]
2001	277,888	21780
2002	276,059	25320
2003	224,597	21247
2004	189,241	17814
2005	131,650	13305

[5] Estimates for 2001-2009 were included as an attachment to a January 5, 2011, Memorandum from Dr. Bonnie Ponwith, SEFSC to Dr. Roy E Crabtree, SERO; estimates for 2010-2012 data were provided by James Nance, SEFSC, to Jennifer Lee, SERO, via attachments to March 5, April 8, and November 1, 2013, and March 21, 2014 emails.

[6] All estimates were provided by David Gloeckner, SEFSC, to Jennifer Lee via attachments to a November 15, 2013 email.

2006	116,710	14348
2007	107,671	13670
2008	87,952	13087
2009	108,501	12502
2010	84,729	14017
2011	96,135	11634
2012	94,100	14265

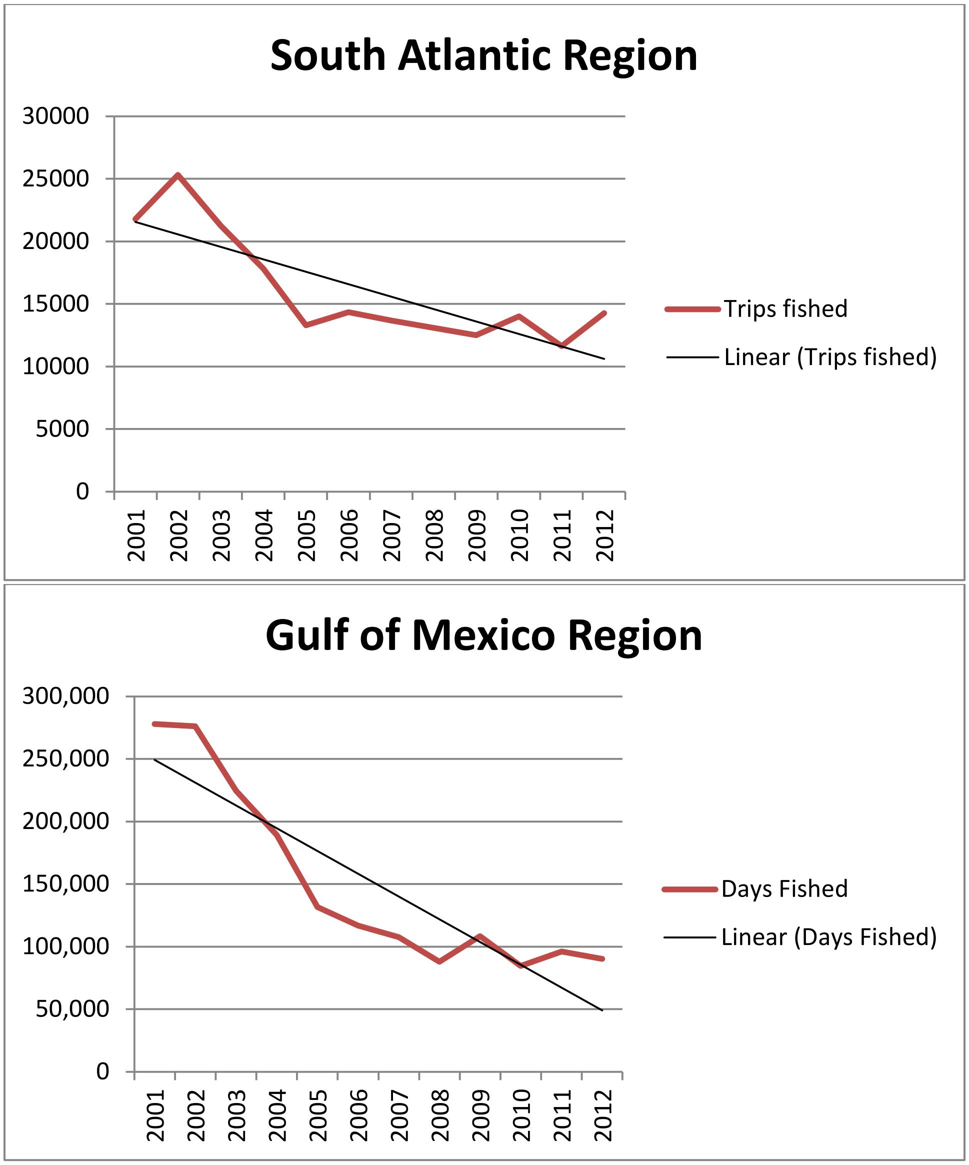

Figure 4. 2001-2012 Shrimp Otter Trawl Effort in the South Atlantic and Gulf of Mexico.

Skimmer trawl fisheries have also 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, we expect average overall participation and effort in the skimmer trawl fisheries to not change substantially in future years.

2.6 Action Area

NMFS's 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 MSFCA, and in state waters, where fisheries are authorized by respective state agencies. Unlike NMFS's authority to manage fisheries under the Magnuson Stevens Act, NMFS's 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 and species proposed for listing 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, nine 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 or Proposed for Listing 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[7]	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/T[8]	South Atlantic
	Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	Gulf
	Smalltooth sawfish	*Pristis pectinata*	E	South Atlantic and Gulf
Invert-ebrates	Staghorn coral	*Acropora cervicornis*	T[9]	South Atlantic and Gulf
	Elkhorn coral	*Acropora palmata*	T[7]	South Atlantic and Gulf
	Pillar coral	*Dendrogyra cylindrus*	E[7]	South Atlantic
	Lobed star coral	*Montastraea annularis*	E[7]	South Atlantic and Gulf
	Mountainous star	Montastraea faveolata	E[7]	South Atlantic and Gulf
	Knobby star coral	*Montastraea franksi*	E[7]	South Atlantic and Gulf
	Rough cactus coral	*Mycetophyllia ferox*	E[7]	South Atlantic and Gulf
	Lamarck's sheet coral	*Agaricia lamarcki*	T[7]	South Atlantic and Gulf
	Elliptical star coral	*Dichocoenia stokesii*	T[7]	South Atlantic and Gulf
Plants	Johnson seagrass	*Halophila johnsonii*	T	South Atlantic, within state waters only

Table 3. Designated Critical Habitat 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 corals	South Atlantic

[7] Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered.
[8] The South Atlantic, Carolina, Chesapeake Bay, and New York Bight DPSs are listed as endangered, while the Gulf of Maine DPS is listed as threatened.
[7] On December 7, 2012, NMFS published a proposed rule that proposed listing 7 new coral species in the action area under the ESA, and proposed reclassifying listed *Acropora* from threatened to endangered (77 FR 73220).

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 effects analysis for this opinion is (1) the effect that NMFS's 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 conservation 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 acroporid (elkhorn and staghorn) corals and would have no effect on Johnson seagrass. We have also determined that the proposed action is not likely to adversely affect designated critical habitats for Gulf sturgeon and elkhorn and staghorn corals and will have no effect on designated critical habitats for North Atlantic right whale, smalltooth sawfish, and Johnson's seagrass. These species and 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; Waring et al. 2006; Waring et al. 2002; Wenzel et al. 1988). 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 [i.e., Gulf of Mexico (GOM) penaeid, South Atlantic (SA) penaeid, SA rock shrimp] was 2.8 km (Scott-Denton et al. 2012). 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, there are no potential routes of effect from the proposed action on north Atlantic right whale critical habitat. 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 and 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. Shrimp trawling involves pulling gear through the water along the sea floor and does not result in any changes to the water depth or temperature of where the gear is fished or in the vicinity. Right whale cow/calf pair sighting s are distributed from shore out to 40m, but the average water depth at of sighting was 12.6 waters m (SD= 7.1 m). The average water depth that South Atlantic penaeid shrimp vessels fish in is 8.8 m, thus in shallower waters, which is shallower than where most cow/calf pairings are sighted, and rock shrimp are fished for in much deeper waters (i.e., water depth averages 61.3 m).

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 United States, 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. The required use of TEDs in the shrimp otter trawls is likely to provide any shortnose sturgeon that enters the trawl with a route of escape. 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. Also, the required tow time restrictions under the sea turtle conservation regulations for other types of trawls (e.g., skimmer trawls) may also benefit shortnose sturgeon by reducing the amount of time a shortnose sturgeon would spend trapped in the net before detected and released. The exemption of sea turtle take via the sea turtle conservation regulations is expected to have no effect on shortnose sturgeon. Therefore, NMFS's 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 2007a). There is no overlap between Johnson seagrass and NMFS-authorized trawl fisheries. Johnson seagrass in the action area is contained within shallow state waters. It is possible that there is a very small amount of overlap between Johnson seagrass and state-managed trawl fisheries. Potential effects to Johnson seagrass from state-authorized trawling stem from trawls being dragged over Johnson seagrass and potentially uprooting them. However, the proposed action in state waters is limited to implementation of the sea turtle conservation regulations and the exemption of sea turtle take through those actions, which would have no effect on how state-authorized trawling may affect Johnson seagrass. 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 the way the gear interacts with the seafloor.

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. 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 way trawls interact with the sea floor, and therefore, have no effect on 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.

Corals
The proposed action is not likely to adversely affect listed or proposed for listing corals. The potential route of effect from the proposed action on listed and proposed for listing corals is via physical damage from NMFS-authorized trawling in federal waters. However, adverse effects from the fishery on these corals are extremely unlikely to occur and are discountable given differences between shrimp and coral preferred habitats, and protective regulations in place prohibiting or limiting trawling in areas where corals 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.[10] 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 30 m and are considered to be environmentally sensitive, requiring

[10] 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 Circle, Suite 306, Charleston, South Carolina 29407-4699.

relatively clear, well circulated waters with optimal water temperatures of 25°-29°C. Thus, shrimp habitats are extremely unlikely to support *Acropora* species. Within the action area, elkhorn and staghorn corals 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 corals is off Broward County and Palm Beach County, respectively. Only approximately 645 sq km (249 sq mi) 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 National Marine Sanctuary in the northwestern Gulf of Mexico. The other corals proposed for listing extend north to Martin County, Florida and to depths of 100 m in hard-bottom areas where light is not limited by water clarity. They occur in the Florida Garden Banks National Marine Sanctuary and other reefs in the Gulf of Mexico (e.g., Pulley's ridge). Like *Acropora* species, they require relatively clear, well circulated waters and are unlikely to occur in shrimp habitat.

Protective regulations are in place prohibiting or limiting trawling in these areas (i.e., East and West Flower Garden Banks, Tortugas Shrimp Sanctuary). In the South Atlantic off Florida, regulations at 15 CFR § 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 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 effects 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 sq mi) of coastal habitat, and the Ten Thousand Islands/Everglades Unit, which comprises approximately 619,013 acres (967 sq mi) 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. They are aimed at providing a way for mobile animals to escape from inside shrimp trawl nets through an opening in the net (i.e., TEDs) and at the water's surface when tow times have been met. TEDs and tow time limits do not alter red mangroves or red mangrove habitat, depth, or salinity.

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 1992b), leatherback sea turtle (NMFS and USFWS 1992a), and loggerhead sea turtle (NMFS and USFWS 2008a); Pacific sea turtle recovery plans (NMFS and USFWS 1998a; NMFS and USFWS 1998b; NMFS and USFWS 1998c; NMFS and USFWS 1998b); and sea turtle status reviews, stock assessments, and biological reports (Conant et al. 2009; NMFS-SEFSC 2001; NMFS-SEFSC 2009a; NMFS and USFWS 1995b; NMFS and USFWS 2007a; NMFS and USFWS 2007b; NMFS and USFWS 2007c; NMFS and USFWS 2007d; NMFS and USFWS 2007e; TEWG 1998; TEWG 2000a; TEWG 2007; TEWG 2009). Sources of background information on the smalltooth sawfish include the smalltooth sawfish status review (NMFS 2000), the proposed and final listing rules, and pertinent other publications [e.g., (Simpfendorfer et al. 2010)]. 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 1995a), and 5-year status review (USFWS and NMFS 2009).

3.2.1 General Threats Faced by All Sea Turtle Species

Sea turtles face numerous natural and anthropogenic threats that shape their status and affect their ability to recover. As many of the threats are either the same or similar in nature for all listed sea turtle species, those identified in this section below are discussed in a general sense for all listed sea turtles. Threat information specific to a particular species are then discussed in the corresponding status sections where appropriate.

Fisheries
Incidental bycatch in commercial fisheries is identified as a major contributor to past declines, and threat to future recovery, for all of the sea turtle species (NMFS and USFWS 1991, 1992, 1993, 2008, 2011).

Domestic fisheries often capture, injure, and kill sea turtles at various life stages. Sea turtles in the pelagic environment are exposed to U.S. Atlantic pelagic longline fisheries. Sea turtles in the benthic environment in waters off the coastal United States are exposed to a suite of other fisheries in federal and state waters. These fishing methods include trawls, gillnets, purse seines, hook-and-line gear [including bottom longlines and vertical lines (e.g., bandit gear, handlines, and rod-reel)], pound nets, 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). The Southeast U.S. shrimp fisheries have historically been the largest fishery threat to benthic sea turtles in the southeastern United States, and continue to interact with and kill large numbers of sea turtles each year.

In addition to domestic fisheries, sea turtles are subject to direct as well as incidental capture in numerous foreign fisheries, further impeding the ability of sea turtles to survive and recover on a global scale. For example, pelagic stage sea turtles, especially loggerheads and leatherbacks, circumnavigating the Atlantic are susceptible to international longline fisheries including the Azorean, Spanish, and various other fleets (Aguilar et al. 1995; Bolten et al. 1994; Crouse 1999). Bottom longlines 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 make 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.

Non-Fishery In-Water Activities
There are also many non-fishery impacts affecting the status of sea turtle species, both in the ocean and on land. In nearshore waters of the United States, 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 1997a). Sea turtles entering coastal or inshore areas have also 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, in-water construction activities, and scientific research activities.

Coastal Development and Erosion Control

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 (Bouchard et al. 1998; Lutcavage et al. 1997). These factors may decrease the amount of nesting area available to females and change the natural behaviors of both adults and hatchlings, directly or indirectly, through loss of beach habitat or changing thermal profiles and increasing erosion, respectively. (Ackerman 1997; Witherington et al. 2003; Witherington et al. 2007). In addition, coastal development is usually accompanied by artificial lighting which can 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). In-water erosion control structures such as breakwaters, groins, and jetties can impact nesting females and hatchling as they approach and leave the surf zone or head out to sea by creating physical blockage, concentrating predators, creating longshore currents, and disrupting of wave patterns.

Environmental Contamination

Multiple municipal, industrial, and household sources, as well as atmospheric transport, introduce various pollutants such as pesticides, hydrocarbons, organochlorides (e.g., DDT, PCBs, and PFCs), and others that may cause adverse health effects to sea turtles (Garrett 2004; Grant and Ross 2002; Hartwell 2004; Iwata et al. 1993). 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 BP's Deepwater Horizon (DWH) well. Official estimates are that millions of barrels of oil were released into the Gulf of Mexico. Additionally, approximately 1.8 million gallons of chemical dispersant was applied on the seawater surface and at the wellhead to attempt to break down the oil. 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.

Marine debris is a continuing problem for sea turtles. Sea turtles living in the pelagic environment commonly eat or become entangled in marine debris (e.g., tar balls, plastic bags/pellets, balloons, and ghost fishing gear) as they feed along oceanographic fronts where debris and their natural food items converge. This is especially problematic for sea turtles that spend all or significant portions of their life cycle in the pelagic environment (i.e., leatherbacks, juvenile loggerheads, and juvenile green turtles).

Climate Change

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 be predicted with any degree of certainty; however, significant impacts to the hatchling sex ratios of sea turtles may result (NMFS and USFWS 2007c). In sea turtles, sex is determined by the ambient sand temperature (during 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).

The effects from increased temperatures may be intensified 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 (Baker et al. 2006; Daniels et al. 1993; Fish et al. 2005). 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 lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish, etc.) which could ultimately affect the primary foraging areas of sea turtles.

Other Threats

Predation by various land predators is a threat to developing nests and emerging hatchlings. The major natural predators of sea turtle nests are mammals, including raccoons, dogs, pigs, skunks, and badgers. Emergent hatchlings are preyed upon by these mammals as well as ghost crabs, laughing gulls, and the exotic South American fire ant (*Solenopsis invicta*). In addition to natural predation, 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 2008a).

Diseases, toxic blooms from algae and other microorganisms, and cold stunning events are additional sources of mortality that can range from local and limited to wide-scale and impacting hundreds or thousands of animals.

Actions Taken to Reduce Threats
Actions have been taken to reduce man-made impacts to 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. Some actions have resulted in significant steps towards reducing the recurring sources of mortality of sea turtles in the environmental baseline and improving the status of all sea turtle populations in the Atlantic and Gulf of Mexico. For example, the TED regulation published on February 21, 2003 (68 FR 8456), represents a significant improvement in the baseline effects of trawl fisheries on sea turtles, though shrimp trawling is still considered to be one of the largest source of anthropogenic mortality for most of our sea turtle species (NMFS-SEFSC 2009a).

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 (NWA) DPS is the only one that occurs within the action area and therefore is the only one considered in this opinion.

Species Description and Distribution
Loggerheads are large sea turtles with the mean straight carapace length (SCL) of adults in the southeast United States being approximately 3 ft (92 cm). The corresponding mass is approximately 255 lb (116 kg) (Ehrhart and Yoder 1978). Adult and sub-adult 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 throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd 1988). Habitat uses within these areas vary by life stage. 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.

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, 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 1997; Addison and Morford 1996), 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 United States 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% in the southeast U.S. Atlantic, 29% in the northeast U.S. Atlantic, 12% in the eastern Gulf of Mexico, and 5% in the western Gulf of Mexico (TEWG 1998).

Within the NWA , 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 of the state 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 as follows: (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 2008a). 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

The Northwest Atlantic Loggerhead Recovery Team defined the following eight life stages for the loggerhead life cycle, including the ecosystems those stages generally use: (1) egg (terrestrial zone), (2) hatchling stage (terrestrial zone), (3) hatchling swim frenzy and transitional stage (neritic zone[11]), (4) juvenile stage (oceanic zone), (5) juvenile stage (neritic zone), (6) adult stage (oceanic zone), (7) adult stage (neritic zone), and (8) nesting female (terrestrial zone) (NMFS and USFWS 2008). Loggerheads are long-lived organisms that 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 female turtles lay eggs throughout the summer months. Female loggerheads deposit an average of 4.1 nests within a nesting season (Murphy and Hopkins 1984) but an individual female only nests every 3.7 years on average (Tucker 2010). Along the southeastern United States, loggerheads lay an average of 100 to 126 eggs per nest (Dodd 1988) which incubate for 42 to 75 days before hatching (NMFS and USFWS 2008b). Hatchling loggerheads are generally 1.5-2 inches in length and weigh about 0.7 ounces (20 grams).

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). Juvenile loggerheads leading a pelagic existence grow at rates of 1-2 inches (2.9-5.4 cm) per year (Bjorndal et al. 2003; Snover 2002) over a period as long as 7-12 years (Bolten et al. 1998) before moving to more coastal habitats. 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 (Bolten and Witherington 2003; Laurent et al. 1998). 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). Stranding records indicate that when immature loggerheads reach 15-24 inches (40-60 cm) SCL, they begin to occur in coastal inshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico (Witzell 2002).

After departing the oceanic zone, neritic juvenile loggerheads in the Northwest Atlantic inhabit continental shelf waters from Cape Cod Bay, Massachusetts, south through Florida, The Bahamas, Cuba, and the Gulf of Mexico. Estuarine waters of the United States, including areas such as Long Island Sound, Chesapeake Bay, Pamlico and Core Sounds, Mosquito and Indian River Lagoons, Biscayne Bay, Florida Bay, and numerous embayments fringing the Gulf of Mexico, comprise important inshore habitat. Along the Atlantic and Gulf of Mexico shoreline, essentially all shelf waters are inhabited by loggerheads.

Like juveniles, non-nesting adult loggerheads also use the neritic zone. However, these adult loggerheads use the relatively enclosed shallow-water estuarine habitats with limited ocean access less frequently than the juveniles. Areas such as Pamlico Sound, North Carolina, and the Indian River Lagoon, Florida, are regularly used by juveniles but not adult loggerheads. In comparison, adult loggerheads tend to use estuarine areas with more open ocean access, such as Chesapeake Bay in the U.S. Mid-Atlantic. 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. Offshore, adults primarily inhabit continental

[11] Neritic refers to the inshore marine environment from the surface to the sea floor where water depths do not exceed 200 meters.

shelf waters, from New York south through Florida, The Bahamas, Cuba, and the Gulf of Mexico. Seasonal use of Mid-Atlantic shelf waters, especially offshore New Jersey, Delaware, and Virginia during summer months, and offshore shelf waters, such as Onslow Bay (off the North Carolina coast), during winter months has also been documented (Hawkes et al. 2007; Georgia Department of Natural Resources, unpublished data; South Carolina Department of Natural Resources, unpublished data). Satellite telemetry has identified the shelf waters along the west Florida coast, The Bahamas, Cuba, and the Yucatán Peninsula as important resident areas for adult female loggerheads that nest in Florida (Foley et al. 2008; Girard et al. 2009; Hart et al. 2012). The southern edge of the Grand Bahama Bank is important habitat for loggerheads nesting on the Cay Sal Bank in The Bahamas, but nesting females are also resident in the bights of Eleuthera, Long Island, and Ragged Islands as well as Florida Bay in the United States, and the north coast of Cuba (A. Bolten and K. Bjorndal, University of Florida, unpublished data). Moncada et al. (2010) report the recapture in Cuban waters of five adult female loggerheads originally flipper tagged in Quintana Roo, Mexico, indicating that Cuban shelf waters likely also provide foraging habitat for adult females that nest in Mexico.

Status and Population Dynamics

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

Numbers of nests and nesting females can vary widely from year to year. Nesting beach surveys, though, can provide a reliable assessment of trends in the adult female population, due to the strong nest site fidelity of female loggerhead sea turtles, as long as such studies are sufficiently long and effort and methods are standardized [see, e.g., (NMFS and USFWS 2008a)]. NMFS and USFWS (2008a) 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.

<u>Peninsular Florida Recovery Unit</u>

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 2008a). The statewide estimated total for 2012 was 98,601 nests (FWRI nesting database).

In addition to the total nest count estimates, the Florida Fish and Wildlife Research Institute (FWRI) uses an index nesting beach survey method. The index survey uses standardized data-collection criteria to measure seasonal nesting and allow accurate comparisons between beaches and between years. This provides a better tool for understanding the nesting trends (Figure 5). FWRI performed a detailed analysis of the long-term loggerhead index nesting data (1989-2012) (http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/). Three distinct trends over that time period were identified. From 1989-1998 there was a 23% increase, that was then followed by a sharp decline over the subsequent decade. However, recent large increases in loggerhead nesting occurred since then. FWRI examined the trend from the 1998 nesting high through 2012 and found the decade-long post-1998 decline had reversed and there was no longer a demonstrable trend. Looking at the data from 1989 through 2012 FWRI concluded that there was an overall positive change in the nest counts.

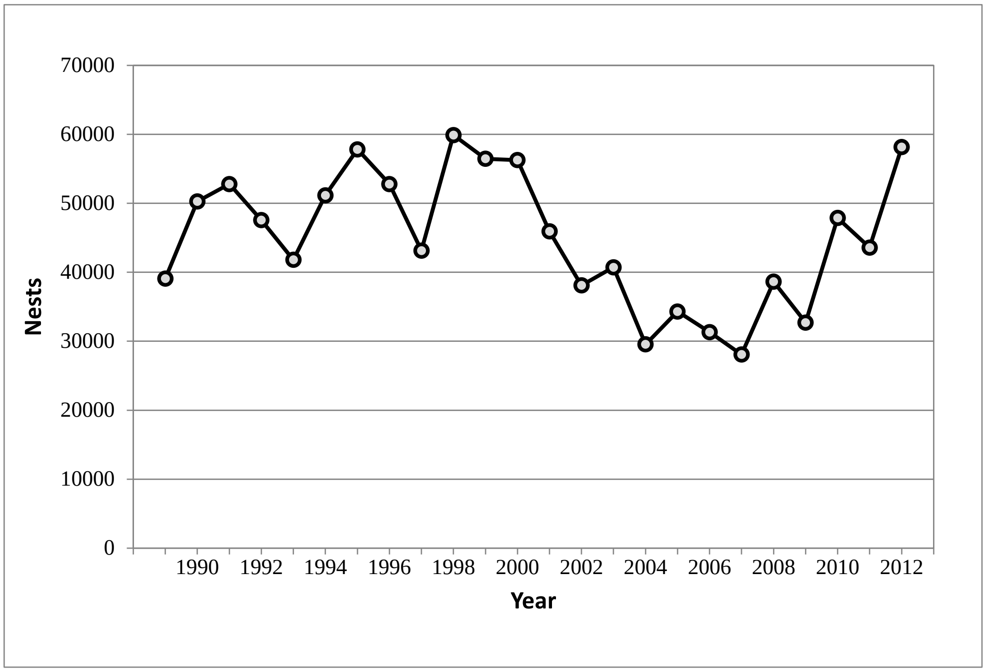

Figure 5. Loggerhead sea turtle nesting at Florida index beaches since 1989.

Northern Recovery Unit

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 (NCWRC) unpublished data, South Carolina Department of Natural Resources (SCDNR) unpublished data), and represent approximately 1,272 nesting females per year, assuming 4.1 nests per female (Murphy and Hopkins 1984). The loggerhead nesting trend from daily beach surveys showed a significant decline of 1.3% annually from 1989-2008. Nest totals from aerial surveys conducted by SCDNR showed a 1.9% annual decline in nesting in South Carolina from 1980 through 2008. Overall, there is strong statistical data to suggest the NRU had experienced a long-term decline over that period of time.

Data since that analysis (Table 4) are showing improved nesting numbers and a departure from the declining trend. Georgia nesting has rebounded to show the first statistically significant increasing trend since comprehensive nesting surveys began in 1989 (Mark Dodd, GADNR press release, http://www.georgiawildlife.com/node/3139). South Carolina and North Carolina nesting have also begun to show a shift away from the past declining trend.

Table 4. Total Number of NRU Loggerhead Nests (GADNR, SCDNR, and NCWRC nesting datasets).

Nests Recorded	2008	2009	2010	2011	2012
Georgia	1,649	997	1,761	1,992	2,218

South Carolina	4,500	2,183	3,141	4,015	4,615
North Carolina	841	276	846	948	1,069
Total	6,990	3,456	5,748	6,955	7,902

South Carolina also conducts an index beach nesting survey similar to the one described for Florida. Although the survey only includes a subset of nesting, the standardized effort and locations allow for a better representation of the nesting trend over time. Increases in nesting were seen for the period from 2009-2012, with 2012 showing the highest index nesting total since the start of the program (Figure 6).

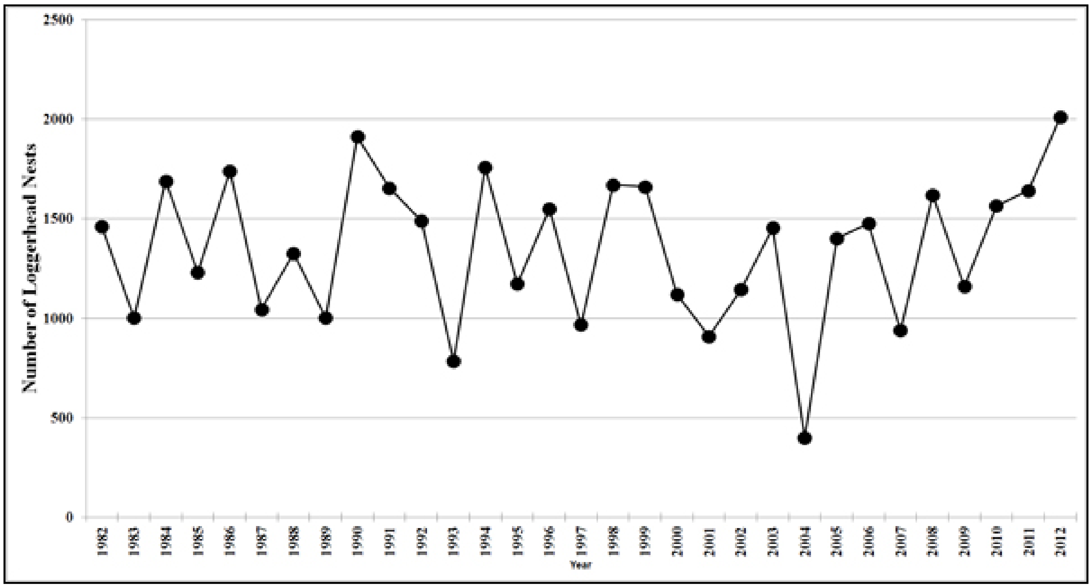

Figure 6. South Carolina Index Nesting Beach Counts for Loggerhead Sea Turtles (from the SCDNR website, http://www.dnr.sc.gov/seaturtle/nest.htm).

Other NW Atlantic DPS Recovery Units

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 2008a). 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 statistically significant declining trend of 4.7% annually (NMFS and USFWS 2008a). 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. 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 7 of the beaches on Quintana Roo, Mexico, from 1987-2001, where survey effort was consistent during the period. Nonetheless, nesting has declined since 2001, and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008a).

In-water Trends

Nesting data are the best current indicator of sea turtle population trends; however, in-water data also provide some insight. Such research suggests the abundance of neritic juvenile loggerheads is steady or increasing. Although Ehrhart et al. (2007) found no significant regression-line trend in a long-term dataset, researchers have observed notable increases in catch per unit effort (CPUE) over the past several years (Arendt et al. 2009; Ehrhart et al. 2007; Epperly et al. 2007). Researchers believe that this increase in CPUE is likely linked to an increase in juvenile abundance, though it is unclear whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence. Bjorndal et al. (2005), cited in NMFS and USFWS (2008a), 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 oceanic/neritic juveniles (historically referred to as small benthic juveniles), which could indicate a relatively large number of individuals around the same age may mature 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 oceanic/neritic juvenile loggerheads, a pattern corroborated by stranding data (TEWG 2009).

Population Estimate

The NMFS Southeast Fishery Science Center developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS-SEFSC 2009). 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. Resulting trajectories of model runs for each individual recovery unit, as well as the western North Atlantic population as a whole, were found to be very similar. The model run estimates, from the adult female population size for the western North Atlantic (from the 2004-2008 time frame),suggests the adult female population size approximately 20,000 to 40,000 individuals, with a low likelihood of being up to 70,000 (NMFS-SEFSC 2009). A less robust estimate for total benthic females in the western North Atlantic was also obtained, yielding approximately 30,000-300,000 individuals, up to less than 1 million (NMFS-SEFSC 2009).

Threats

The threats faced by loggerhead sea turtles are well-summarized in the general discussion of threats in Section 3.2.1. Yet, the impact of fishery interactions is a point of further emphasis for this species. The Loggerhead Biological Review Team determined that the greatest threats to the NWA DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009).

Regarding the impacts of pollution, loggerheads may be particularly affected by organochlorine contaminants as they were observed to have the highest organochlorine 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).

Specific information regarding potential climate change impacts on loggerheads is also available. Modeling suggests an increase of 2°C in air temperature would result in a sex ratio of over 80% 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% female offspring. Such highly skewed sex ratios could undermine the reproductive capacity of the species. 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 also been correlated with an earlier onset of loggerhead nesting in the spring (Hawkes et al. 2007; Weishampel et al. 2004), as well as short inter-nesting intervals (Hays et al. 2002) and shorter nesting season (Pike et al. 2006).

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.

Species Description and Distribution
The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 lb (159 kg) and a straight carapace length of greater than 3.3 ft (1 m). 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, or brown and black in starburst or irregular patterns (Lagueux 2001).

With the exception of post-hatchlings, green sea turtles live in nearshore tropical and subtropical waters where they generally feed on marine algae and seagrasses. They have specific foraging grounds and may make large migrations between these forage sites and natal beaches for nesting (Hays et al. 2001). Green sea turtles nest on sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands 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 Pacific coast of Australia along the Great Barrier Reef.

Differences in mitochondrial DNA properties of green sea turtles from different nesting regions indicate there are genetic subpopulations (Bowen et al. 1992; Fitzsimmons et al. 2006). Despite the genetic differences, sea turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species' range. Such mixing occurs at extremely low levels in Hawaiian foraging areas, perhaps making this central Pacific population the most isolated of all green sea turtle populations occurring worldwide (Dutton et al. 2008).

In U.S. Atlantic and Gulf of Mexico waters, green sea turtles are distributed throughout 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 (Doughty 1984; Hildebrand 1982; Shaver 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957; Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon system 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 sea 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.

The complete nesting range of green sea turtles within the southeastern United States includes sandy beaches between Texas and North Carolina, as well as the U.S. Virgin Islands and Puerto Rico (Dow et al. 2007; NMFS and USFWS 1991). Still, 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).

*Life History Informati*on

Green sea turtles reproduce sexually, and mating occurs in the waters off nesting beaches. Mature females return to their natal beaches (i.e., the same beaches where they were born) to lay eggs (Balazs 1982; Frazer and Ehrhart 1985) every 2-4 years while males are known to reproduce every year (Balazs 1983). In the southeastern United States, 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). Eggs incubate for approximately two months before hatching. Hatchling green sea turtles are approximately 2 inches (5 cm) in length and weigh approximately 0.9 ounces (25 grams). 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., along the Great Barrier Reef in Australia) showing higher survivorship values than nesting sites known to be highly disturbed (e.g., Nicaragua (Campbell and Lagueux 2005; Chaloupka and Limpus 2005)).

After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years. During this life stage, green sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. This early oceanic phase remains one of the most poorly understood aspects of green sea turtle life history (NMFS and USFWS 2007b). Green sea turtles exhibit particularly slow growth rates of about 0.4-2 inches (1-5 cm) per year (Green 1993; McDonald-Dutton and Dutton 1998), which may be attributed to their largely herbivorous, low-net energy diet (Bjorndal 1982). At approximately 8-10 inches (20-25 cm) carapace length, juveniles leave the pelagic environment and enter nearshore developmental habitats such as protected lagoons and open coastal areas rich in sea grass and marine algae. Growth studies using skeletochronology indicate that green sea turtles in the western Atlantic shift from the oceanic phase to nearshore developmental habitats after approximately 5-6 years (Bresette et al. 2006; Zug and Glor 1998). Within the developmental habitats, juveniles begin the switch to a more herbivorous diet, and by adulthood feed almost exclusively on seagrasses and algae (Rebel 1974), although some populations are known to also feed heavily on invertebrates (Carballo et al. 2002). Green sea turtles reach sexual maturity at 20-50 years of age (Chaloupka and Musick 1997; Hirth and USFWS 1997), which is considered one of the longest ages to maturity of any sea turtle species.

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 sea turtles have been identified through flipper tagging and/or satellite telemetry. Based on these studies, the majority of adult female Florida green sea turtles are believed to reside in nearshore foraging areas throughout the Florida Keys and in the waters southwest of Cape Sable, with some post-nesting turtles also residing in Bahamian waters as well (NMFS and USFWS 2007b).

Status and Population Dynamics

Population estimates for marine turtles do not exist because of the difficulty in sampling turtles over their geographic ranges and within their marine environments. However, researchers have used nesting data to study trends in reproducing sea turtles over time. A summary of nesting trends is provided in the most recent 5-year status review for the species (NMFS and USFWS 2007b) 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). 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 (i.e., the 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 (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 1970s. For instance, from 1971-1975 there were approximately 41,250 average annual emergences documented and this number increased to an average of 72,200 emergences from 1992-1996 (Bjorndal et al. 1999). 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 nesting 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% annually.

In the continental United States, green sea 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 (Meylan et al. 1995). More recently, green sea turtle nesting has occurred in North Carolina on Bald Head Island, 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).

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, the pattern of green sea turtle nesting has generally shown biennial peaks in abundance with a positive trend during the ten years of regular monitoring (Figure 7). According to data collected from Florida's index nesting beach survey from 1989-2012, green sea turtle nest counts across Florida have increased approximately ten-fold from a low of 267 in the early 1990s to a high of 25,553 in 2013. Two consecutive years of nesting declines in 2008 and 2009 caused some concern, but this was followed by increases in both 2010 and 2011 (Figure 7). Modeling by Chaloupka et al. (2008) 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%.

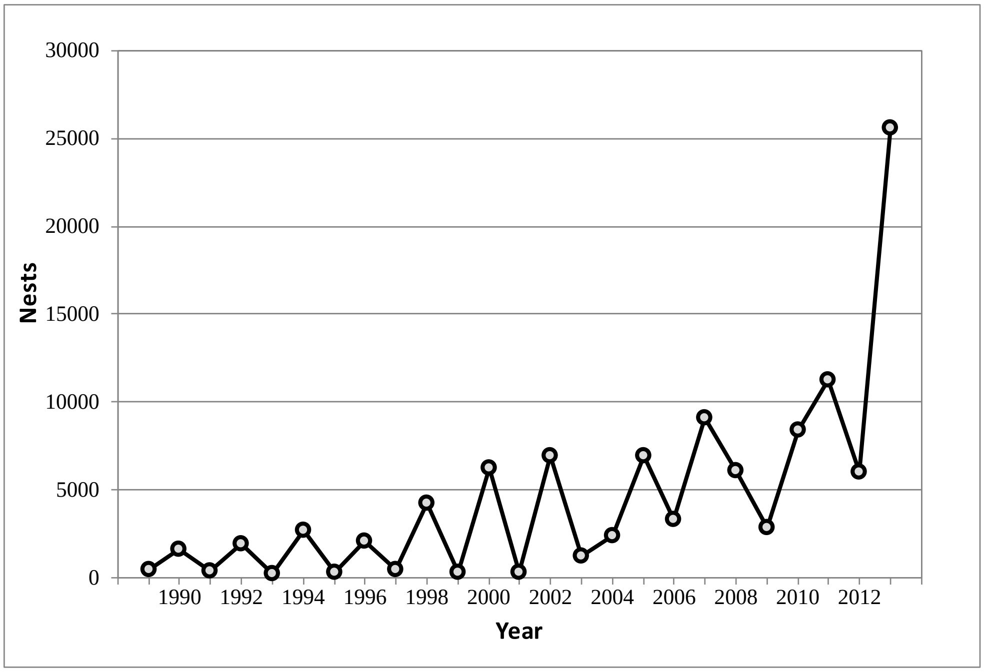

Figure 7. Green sea turtle nesting at Florida index beaches since 1989.

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of the species 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. Green sea turtles also face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (e.g., plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (e.g., nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 3.2.1.

In addition to general threats, green sea turtles are susceptible to natural mortality from Fibropapillomatosis (FP) disease. FP results in the growth of tumors on soft external tissues (flippers, neck, tail, etc.), the carapace, the eyes, the mouth, and internal organs (gastrointestinal tract, heart, lungs, etc.) of turtles (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). These tumors range in size from 0.1 cm to greater than 30 cm in diameter and may affect swimming, vision, feeding, and organ function (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). Presently, scientists are unsure of the exact mechanism causing this disease, though it is believed to be related to both an infectious agent, such as a virus (Herbst et al. 1995), and environmental conditions [e.g., habitat degradation, pollution, low wave energy, and shallow water (Foley et al. 2005)]. Presently, FP is cosmopolitan, but has been found to affect large numbers of animals in specific areas, including Hawaii and Florida (Herbst 1994; Jacobson 1990; Jacobson et al. 1991).

Cold-stunning is another natural threat to green sea turtles. Although it 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 1,650 green sea turtles being found cold-stunned in Texas. Of these, approximately 620 were found dead or died after stranding, and approximately 1,030 were rehabilitated and released. Additionally, during this same time frame, approximately 340 green sea turtles were found cold-stunned in Mexico, though approximately 300 of those were subsequently rehabilitated and released.

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.

Species Description and Distribution
The leatherback is the largest sea turtle in the world, with a curved carapace length (CCL) often exceeding 5 ft (150 cm) and front flippers that can span almost 9 ft (270 cm) (NMFS and USFWS 1998). Mature males and females can reach lengths of over 6 ft (2 m) and weigh close to 2,000 lb (900 kg). Leatherbacks do not have a bony shell. A leatherback's shell is approximately 1.5 inches (4 cm) thick and consists of a leathery, oil-saturated connective tissue overlaying loosely interlocking dermal bones. The ridged shell and large flippers help the leatherback during long-distance trips in search of food.

Leatherbacks have several unique traits that enable them to live in cold water, unlike other sea turtles. For example, leatherbacks have a countercurrent circulatory system (Greer et al. 1973),[12] a thick layer of insulating fat (Davenport et al. 1990; Goff and Lien 1988), gigantothermy (Paladino et al. 1990),[13] and they can increase their body temperature through increased metabolic activity (Bostrom and Jones 2007; Southwood et al. 2005). These adaptations allow leatherbacks to be comfortable in a wide range of temperatures and to travel further than any other sea turtle species (NMFS and USFWS 1995). For example, a leatherback may swim more than 6,000 miles (10,000 km) in a single year (Benson et al. 2007a; Benson et al. 2011; Eckert

[12] Countercurrent circulation is a highly efficient means of minimizing heat loss through the skin's surface because heat is recycled. For example, a countercurrent circulation system often has an artery containing warm blood from the heart surrounded by a bundle of veins containing cool blood from the body surface. As the warm blood flows away from the heart it passes much of its heat to the colder blood returning to the heart via the veins. This conserves heat by recirculating it back to the body core.
[13] "Gigantothermy" refers to a condition when an animal has relatively high volume compared to its surface area, and as a result, it losses less heat.

2006b; Eckert et al. 2006). They search for food between latitudes 71°N and 47°S, in all oceans, and travel extensively 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). While leatherbacks will look for food in coastal waters, they appear to prefer the open ocean at all life stages (Heppell et al. 2003). Leatherbacks have pointed tooth-like cusps and sharp-edged jaws that are adapted for a diet of soft-bodied prey, like jellyfish and salps. A leatherback's mouth and throat also have backward-pointing spines that help retain jelly-like prey. Leatherback's favorite prey (e.g., medusae, siphonophores, and salps), occur commonly in temperate and boreal latitudes and 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.

Genetic analyses using microsatellite markers along with mitochondrial DNA and tagging data indicate there are seven groups or breeding populations in the Atlantic Ocean: 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

The leatherback life cycle is broken into several stages: (1) egg/hatchling, (2) post-hatchling, (3) juvenile, (4) sub-adult, and (5) adult. Leatherbacks are a long-lived species that delay age of maturity, have low and variable survival in the egg and juvenile stages, and have relatively high and constant annual survival in the sub-adult and adult life stages (Chaloupka 2002; Crouse 1999; Heppell et al. 1999; Heppell et al. 2003; Spotila et al. 1996b; Spotila et al. 2000).

Leatherbacks are believed to live a long time. While a robust estimate of the leatherback sea turtle's life span does not exist, the current best estimate for the maximum age is 43 (Avens et al. 2009). It is still unclear when leatherbacks first become sexually mature. Using skeletochronological data, Avens et al. (2009) estimated that leatherbacks in the western North Atlantic may not reach maturity until 29 years of age, which is longer than earlier estimates by Pritchard and Trebbau (1984), 2-3 years; Rhodin (1985), 3-6 years; Zug and Parham (1996), 13-14 years for females; and Dutton et al. (2005), 12-14 years for leatherbacks nesting in the U.S. Virgin Islands. A more recent study that examined leatherback growth rates estimated an age at maturity of 16.1 years (Jones et al. 2011).

The average size of reproductively active females in the Atlantic is generally 5-5.5 ft (150-162 cm) CCL (Benson et al. 2007a; Hirth et al. 1993; Starbird and Suarez 1994). However, females as small as 3.5-4 ft (105-125 cm) CCL have been observed nesting at various sites (Stewart et al. 2007).

Female leatherbacks typically nest on sandy, tropical beaches at intervals of 2 to 4 years (Garcia M. and Sarti 2000; McDonald and Dutton 1996; Spotila et al. 2000). Unlike other sea turtle species, female leatherbacks do not always nest at the same beach year after year, some females may even nest at different beaches during the same year (Dutton et al. 2005; Eckert et al. 1989; Keinath and Musick 1993; Steyermark et al. 1996). Individual female leatherbacks have been observed with fertility spans as long as 25 years (Hughes 1996). Females usually lay up to 10 nests during the 3-6 month nesting season (March through July in the United States), typically 8 to 12 days apart, with 100 eggs or more per nest (Eckert et al. 2012; Eckert et al. 1989; Maharaj 2004; Matos ; Stewart and Johnson 2006; Tucker 1988). However, up to approximately 30% of the eggs may be infertile (Eckert et al. 1989; Maharaj 2004; Matos ; MTN 1984; Stewart and Johnson 2006; Tucker 1988). The number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergent success) is approximately 50% worldwide (Eckert et al. 2012), which is lower than the emergent success rate of greater than 80% reported for other sea turtle species (Miller 1997). In the United States the emergent success is higher at 54%-72% (Eckert and Eckert 1990; Stewart and Johnson 2006; Tucker 1988). Thus, the number of hatchlings in a given year may be less than the total number of eggs produced in a season. Eggs hatch after 60-65 days, and the hatchlings have white striping along the ridges of their backs and on the edges of the flippers. Leatherback hatchlings are approximately 2-3 inches (51-76 mm) in length, with fore flippers as long as their bodies, and weigh approximately 1.5-2 ounces (40-50 g). Hatchlings grow rapidly with reported growth rates for leatherbacks 2.5-27.6 inches (6-70 cm) in length estimated at 12.6 inches (32 cm) per year (Jones et al. 2011).

In the Atlantic Basin, the sex ratio appears to be skewed toward females. TEWG (2007) reports that nearshore and onshore strandings data from the U.S. Atlantic and Gulf of Mexico coasts indicate that 60% of strandings were females. Those data also show that the proportion of females among adults (57%) and juveniles (61%) was also skewed toward females in these areas (TEWG 2007). James et al. (2007) collected size and sex data from large sub-adult and adult leatherbacks off Nova Scotia and also concluded a bias toward females at a rate of 1.86:1.

The survival and mortality rates for leatherbacks are difficult to estimate and vary by location. For example, the annual mortality rate for leatherbacks that nested at Playa Grande, Costa Rica, was estimated to be 34.6% in 1993-1994 and 34.0% in 1994-1995 (Spotila et al. 2000). In contrast leatherbacks nesting in French Guiana and St. Croix had estimated annual survival rates of 91% (Rivalan et al. 2005) and 89% (Dutton et al. 2005), respectively. For the St. Croix population, the average annual juvenile survival rate was estimated to be approximately 63%, and the total survival rate from hatchling to first year of reproduction for a female was estimated to be between 0.4 and 2% [assuming age at first reproduction is between 9 and 13 years (Eguchi et al. 2006)]. Spotila et al. (1996a) estimated first year survival rates for leatherbacks at 6.25%.

Migratory routes of leatherbacks are not entirely known. However, recent information from satellite tags have documented long travels between nesting beaches and foraging areas in the Atlantic and Pacific Ocean basins (Benson et al. 2007a; Benson et al. 2011; Eckert 2006a; Eckert et al. 2006; Ferraroli et al. 2004; Hays et al. 2004; James et al. 2005). Leatherbacks nesting in Central America and Mexico travel thousands of miles into tropical and temperate waters of the South Pacific (Eckert and Sarti 1997; Shillinger et al. 2008). Data from satellite tagged leatherbacks suggest that they may be traveling in search of seasonal aggregations of jellyfish (Benson et al. 2007b; Bowlby et al. 1994; Graham 2009; Shenker 1984; Starbird et al. 1993; Suchman and Brodeur 2005).

Status and Population Dynamics

The status of the Atlantic leatherback population has been less clear than the Pacific population, which has shown dramatic declines at many nesting sites (Santidrián-Tomillo et al. 2007; Sarti Martínez et al. 2007; Spotila et al. 2000). 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). Leatherbacks also show a lesser degree of nest-site fidelity than occurs with the hardshell sea turtle species. However, coordinated efforts of 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 most of the nesting occurring in the Guianas and Trinidad. The Southern Caribbean/Guianas stock of leatherbacks was designated after genetics studies indicated that animals from the Guianas (and possibly Trinidad) should be viewed as one population. Using nesting females as a proxy for population, the TEWG (2007) determined that the Southern Caribbean/Guianas stock had demonstrated a long-term, positive population growth rate. 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). More specifically, Wallace et al. (2013) report an estimated three-generation abundance change of +3%, +20,800%, +1,778%, and +6% in Trinidad, Guyana, Suriname, and French Guiana, respectively.

Researchers believe the cyclical pattern of beach erosion and then reformation has affected leatherback nesting patterns in the Guianas. For example, between 1979 and 1986 the number of leatherback nests in French Guiana had increased by about 15% annually(NMFS-SEFSC 2001). This was then followed by a nesting decline of about 15% annually. This decline corresponded with the erosion of beaches in French Guiana and increased nesting in Suriname. This pattern suggests that the declines observed since 1987 might actually be a part of a nesting cycle that coincides with cyclic beach erosion in Guiana (Schultz 1975). Researchers think that the cycle of erosion and reformation of beaches may have changed where leatherbacks nest throughout this region. The idea of shifting nesting beach locations was supported by increased nesting in Suriname.[14] These increases were happening at the same time that the number of nests was declining at beaches that had previously shown large increases in nesting (Hilterman et al. 2003), though this information suggested the long-term trend for the overall Suriname and French Guiana population was increasing.

The Western Caribbean stock includes nesting beaches from Honduras to Colombia. Across the Western Caribbean, nesting here is most prevalent 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 index nesting beaches in Tortuguero, Gandoca, and Pacuaré in Costa Rica indicate that the nesting population likely was not growing over the

[14] Leatherback nesting in Suriname increased by more than 10,000 nests per year since 1999 and a peak of 30,000 nests in 2001.

1995-2005 time series (TEWG 2007). Other modeling of the nesting data for Tortuguero indicates a possible 67.8% decline between 1995 and 2006 (Troëng et al. 2007). Wallace et al. (2013) report an estimated three-generation abundance change of -72%, -24%, and +6% for Tortuguero, Gandoca, and Pacuare, respectively. .

Nesting data for the Northern Caribbean stock is available from Puerto Rico, St. Croix (USVI), 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% (TEWG 2007). Wallace et al. (2013) report an estimated three-generation abundance change of -4% and +5,583% at Culebra and Fajardo, respectively. At the primary nesting beach on St. Croix, the Sandy Point National Wildlife Refuge, nesting has varied from a few hundred nests to a high of 1,008 in 2001, and the average annual growth rate has been approximately 1.1% from 1986-2004 (TEWG 2007). From 2006-2010, Wallace et al. (2013) report an annual growth rate of +7.5% in St. Croix and a three-generation abundance change of +1,058%. 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% 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% between 1989 and 2005. FWC Index Nesting Beach Survey Data indicates biennial peaks in nesting abundance beginning in 2007 (Figure 8 and Table 5). A similar pattern was also observed statewide (Table 5). 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. Overall, the trend shows growth on Florida's east coast beaches. Wallace et al. (2013) report an annual growth rate of 9.7% and a three-generation abundance change of +1,863%.

Table 5. Number of Leatherback Sea Turtle Nests in Florida.

Nests Recorded	2007	2008	2009	2010	2011
Index Nesting Beaches	517	265	615	552	625
Statewide	1,442	728	1,747	1,334	1,652

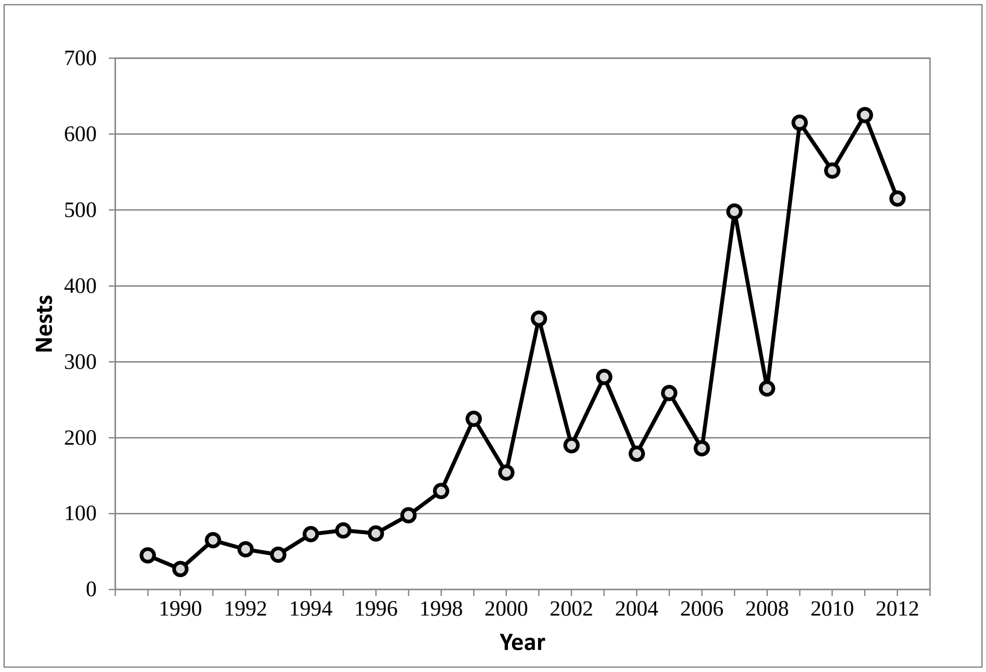

Figure 8. Leatherback sea turtle nesting at Florida index beaches since 1989.

The West African nesting stock of leatherbacks is large and important, but is a 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. 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 stocks nest on the beaches of Brazil and South Africa. Based on the data available, TEWG (2007) determined that between 1988 and 2003 there was a positive annual average growth rate between 1.07 and 1.08% for the Brazilian stock. TEWG (2007) estimated an annual average growth rate between 1.04 and 1.06% for the South African stock.

Because the available nesting information is inconsistent, it is difficult to estimate the total population size for Atlantic leatherbacks. Spotila et al. (1996b) characterized the entire Western Atlantic population as stable at best and estimated a population of 18,800 nesting females. Spotila et al. (1996b) further estimated that the adult female leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, was about 27,600 (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 (2007). The TEWG (2007) also determined that at of the time of their publication, leatherback sea turtle populations in the Atlantic were all stable or increasing with the exception of the Western Caribbean and West Africa populations. The latest review by NMFS and USFWS (2013) suggests the leatherback nesting population is stable in most nesting regions of the Atlantic Ocean.

Threats

Leatherbacks face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 3.2.1; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact leatherback sea turtles.

Of all sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, especially gillnet and pot/trap lines. This may be because 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). 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 (Lutcavage et al. 1997; Shoop and Kenney 1992). The stomach contents of leatherback sea turtles revealed that a substantial percentage (33.8%; 138 of 408 cases examined) contained some form of plastic debris (Mrosovsky et al. 2009). Plastic blocking the gut to an extent that could have caused death was evident in 8.7% of all leatherbacks that ingested plastic (Mrosovsky et al. 2009). Mrosovsky et al. (2009) also note that in a number of cases, the ingestion of plastic may not cause death outright, but could cause the animal to absorb fewer nutrients from food, eat less in general, etc., all of which could cause other adverse effects. 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.

As discussed in Section 3.2.1, 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 2007). Several studies have shown leatherback distribution is influenced by jellyfish abundance [e.g., (Houghton et al. 2006; Witt et al. 2007; Witt et al. 2006)]; 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).

Species Description and Distribution

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. Hawksbill sea turtles are small to medium-sized (99 to 150 lb on average [45 to 68 kg]) although nesting females are known to weigh up to 176 lb (80 kg) 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 1.7 in (42 mm) long, are mostly brown, and somewhat heart-shaped (Eckert 1995; Hillis and Mackay 1989; Van Dam and Sarti 1989).

Hawksbill sea 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 United States, in the Greater and Lesser Antilles, and along the mainland of Central America south to Brazil (Amos 1989; Groombridge and Luxmoore 1989; Lund 1985; Meylan and Donnelly 1999; NMFS and USFWS 1998b; Plotkin and Amos 1988; Plotkin and Amos 1990). They are highly migratory and use a wide range of habitats during their lifetimes (Musick and Limpus 1997; Plotkin 2003). Adult hawksbill sea turtles are capable of migrating long distances between nesting beaches and foraging areas. For instance, a female hawksbill sea turtle tagged at Buck Island Reef National Monument (BIRNM) was later identified 1,160 miles (1,866 km) away in the Miskito Cays in Nicaragua (Spotila 2004).

Hawksbill sea turtles nest on 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). Meylan and Donnelly (1999) believe that the widely dispersed nesting areas and low nest densities is likely a result of overexploitation of previously large colonies that have since been depleted over time. The most significant nesting within the United States occurs in Puerto Rico and the U.S. Virgin Islands, specifically on Mona Island and BIRNM, respectively. Although nesting within the continental United States 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 Peninsula of Mexico, where several thousand nests are recorded annually in the states of Campeche, Yucatán, and Quintana Roo (Garduño-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 2007).

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 and Witzell 1996). Since hawksbill sea turtles nest primarily on the beaches where they were born, if a nesting population is wiped out it might not be replenished by sea turtles 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 0.4-1.2 in (1-3 cm) per year measured in the Indo-Pacific (Chaloupka and Limpus 1997; Mortimer et al. 2003; Mortimer et al. 2002; Whiting 2000) to a high of 2 in (5 cm) or more per year measured at some sites in the Caribbean (Díez and Dam 2002; León and Díez 1999). Differences in growth rates are likely due to differences in diet and/or density of sea turtles at foraging sites and overall time spent foraging (Bjorndal and Bolten 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 sea turtles found in the Indo-Pacific [i.e., 30-40 years, (Boulan 1983; Boulon 1994; Díez and Dam 2002; Limpus and Miller 2000)]. Males are typically mature when their length reaches 27 in (69 cm) while females are typically mature at 30 in [75 cm, (Eckert et al. 1992; Limpus 1992)]. Female hawksbills return to their natal (site of their birth) beaches every 2-3 years to nest (van Dam et al. 1991; Witzell 1983) and generally lay 3-5 nests per season (Richardson et al. 1999). Compared with other sea turtles, the number of eggs per nest (clutch) for hawksbills can be quite high. The largest clutches recorded for any sea turtle belong to hawksbills [approximately 250 eggs per nest, (Hirth and Abdel Latif 1980)], though nests in the U.S. Caribbean and Florida more typically contain approximately 140 eggs (USFWS hawksbill fact sheet, http://www.fws.gov/northflorida/SeaTurtles/ Turtle%20Factsheets/ hawksbill-sea-turtle.htm). Eggs incubate for approximately 60 days before hatching (USFWS hawksbill fact sheet). Hatchling hawksbill sea turtles typically measure 1-2 inches (2.5-5 cm) in length and weigh approximately 0.5 ounces (15 grams).

Hawksbills may undertake developmental migrations (migrations as immatures) and reproductive migrations that involve travel over many tens to thousands of miles (Meylan 1999a). Post-hatchlings (oceanic stage juveniles) are believed to live in the open ocean, taking shelter in floating algal mats and drift lines of flotsam and jetsam in the Atlantic and Pacific oceans (Musick and Limpus 1997) before returning to more coastal foraging grounds. In the Caribbean, hawksbills are known to almost exclusively feed on sponges (Meylan 1988; van Dam and Díez 1997) although at times they have been seen foraging on other food items, notably corallimorphs and zooanthids (León and Díez 2000; Mayor et al. 1998; van Dam and Díez 1997).

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 nesting beaches or to courtship stations along the migratory corridor. Hawksbills show a high fidelity to their foraging areas as well (van Dam and Díez 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 Díez 1998).

Status and Population Dynamics

There are currently no reliable estimates of population abundance and trends for non-nesting 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 2007). The largest nesting population of hawksbills occurs 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 United States, about 500-1,000 hawksbill nests were typically laid on Mona Island, Puerto Rico in the past (Diez and van Dam 2007), but the numbers appear to be increasing, as nearly 1,600 nests were counted by Puerto Rico Department of Natural and Environmental Resources in 2010 (PRDNER nesting data). Another 56-150 nests are typically laid on Buck Island off St. Croix (Meylan 1999b; Mortimer and Donnelly 2008). Nesting also occurs to a lesser extent on beaches on Culebra Island and Vieques Island in Puerto Rico, the mainland of Puerto Rico, and additional beaches on St. Croix, St. John, and St. Thomas.

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 years ago) 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 that showed recent increases are located in the Caribbean. 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 BIRNM was expanded in 2001.

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). Even so, while still critically low in numbers, sightings of hawksbills in the eastern Pacific appear to have been increasing since 2007, though some of that increase may be attributable to better observations (Gaos et al. 2010). More information about site specific trends can be found in the most recent five year status review for the species [see (NMFS and USFWS 2007)].

Threats

Hawksbills are currently subjected 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 Section 3.2.1. There are also specific threats that are of special emphasis, or are unique, for hawksbill sea turtles discussed in further detail below.

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 shells from hundreds of thousands of sea turtles in the western Caribbean region were imported into the United Kingdom and France during the 19th and early 20th centuries (Parsons 1972) and additional hundreds of thousands of sea 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 sea 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 sea 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 sea 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) (Crabbe 2008; Wilkinson 2004). Continued loss of coral reef communities (especially in the greater Caribbean region) is expected to impact foraging and represents a major threat to the recovery of the species.

3.2.5 Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle was listed as endangered on December 2, 1970, under the Endangered Species Conservation Act of 1969, a precursor to the ESA. Internationally, the Kemp's ridley is considered the most endangered sea turtle (Groombridge 1982; TEWG 2000; Zwinenberg 1977).

Species Description and Distribution

The Kemp's ridley sea turtle is the smallest of all sea turtles. Adults generally weigh less than 100 lb (45 kg) and have a carapace length of around 2.1 ft (65 cm). Adult Kemp's ridley shells are almost as wide as they are long. Coloration changes significantly during development from the grey-black dorsum and plastron of hatchlings, a grey-black dorsum with a yellowish-white plastron as post-pelagic juveniles, and then to the lighter grey-olive carapace and cream-white or yellowish plastron of adults. There are 2 pairs of prefrontal scales on the head, 5 vertebral scutes, usually 5 pairs of costal scutes, and generally 12 pairs of marginal scutes on the carapace. In each bridge adjoining the plastron to the carapace, there are four scutes, each of which is perforated by a pore.

Kemp's ridley habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 ft (37 m) deep, although they can also be found in deeper offshore waters. These areas support the primary prey species of the Kemp's ridley sea turtle, which consist of swimming crabs, but may also include fish, jellyfish, and an array of mollusks.

The primary range of Kemp's ridley sea turtles is within the Gulf of Mexico basin, though they also occur in coastal and offshore waters of the U.S. Atlantic Ocean. Juvenile Kemp's ridley sea turtles, possibly carried by oceanic currents, have been recorded as far north as Nova Scotia. Historic nesting records range from Mustang Island, Texas, in the north, to Veracruz, Mexico, in the south. Kemp's ridley sea turtles have recently been nesting along the Atlantic Coast of the United States, with nests recorded from beaches in Florida, Georgia, and the Carolinas. In 2012, the first Kemp's ridley sea turtle nest was recorded in Virginia. The Kemp's ridley nesting population is exponentially increasing, which may indicate a similar increase in the population as a whole (NMFS et al. 2011).

Life History Information

Kemp's ridley sea turtles share a general life history pattern similar to other sea turtles. Females lay their eggs on coastal beaches where the eggs incubate in sandy nests. After 45-58 days of embryonic development, the hatchlings emerge and swim offshore into deeper, ocean water where they feed and grow until returning at a larger size. Hatchlings generally range from 1.65-1.89 in (42-48 mm) SCL, 1.26-1.73 in (32-44 mm) in width, and 0.3-0.4 lb (15-20 g) in weight. The return to nearshore coastal habitats typically occurs around 2 years of age (Ogren 1989), although the time spent in the oceanic zone may vary from 1-4 years or perhaps more (TEWG 2000). Juvenile Kemp's ridley sea turtles use these nearshore coastal habitats from April through November, but move towards more suitable overwintering habitat in deeper offshore waters (or more southern waters along the Atlantic coast) as water temperature drops.

The average rates of growth may vary by location, but generally fall within 2.2-2.9 ± 2.4 in per year (5.5-7.5 ± 6.2 cm/year) (Schmid and Barichivich 2006; Schmid and Woodhead 2000). Age to sexual maturity ranges greatly from 5-16 years, though NMFS et al. (2011) determined the best estimate of age to maturity for Kemp's ridley sea turtles was 12 years. It is unlikely that most adults grow very much after maturity. While some sea turtles nest annually, the weighted mean remigration rate for Kemp's ridley sea turtles 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).

Population Dynamics
Of the seven 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 beaches of Rancho Nuevo, Mexico (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, however, nesting numbers from Rancho Nuevo and adjacent Mexican beaches were below 1,000 (with a low of 702 nests in 1985). Yet, nesting steadily increased through the 1990s, and then accelerated during the first decade of the 21st century (Figure 9), indicating the species is recovering. It is worth noting that when the Bi-National Kemp's Ridley Sea Turtle Population Restoration Project was initiated in 1978, only Rancho Nuevo nests were recorded. In 1988, nesting data from southern beaches at Playa Dos and Barra del Tordo were added, in 1989, data from the northern beaches of Barra Ostionales and Tepehuajes were added, and, most recently in 1996, data from La Pesca and Altamira beaches were recorded. Currently, nesting at Rancho Nuevo accounts for just over 81% of all recorded Kemp's ridley nests in Mexico. Following a significant, unexplained 1-year decline in 2010, Kemp's ridley nests in Mexico reached a record high of 21,797 in 2012 (Gladys Porter Zoo nesting database 2013); in 2013 there was a second significant decline, with only 16,385 nests recorded. A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 42 in 2004, to a record high of 209 nests in 2012 (National Park Service data, http://www.nps.gov/pais/naturescience/strp.htm, http://www.nps.gov/pais/naturescience/current-season.htm).

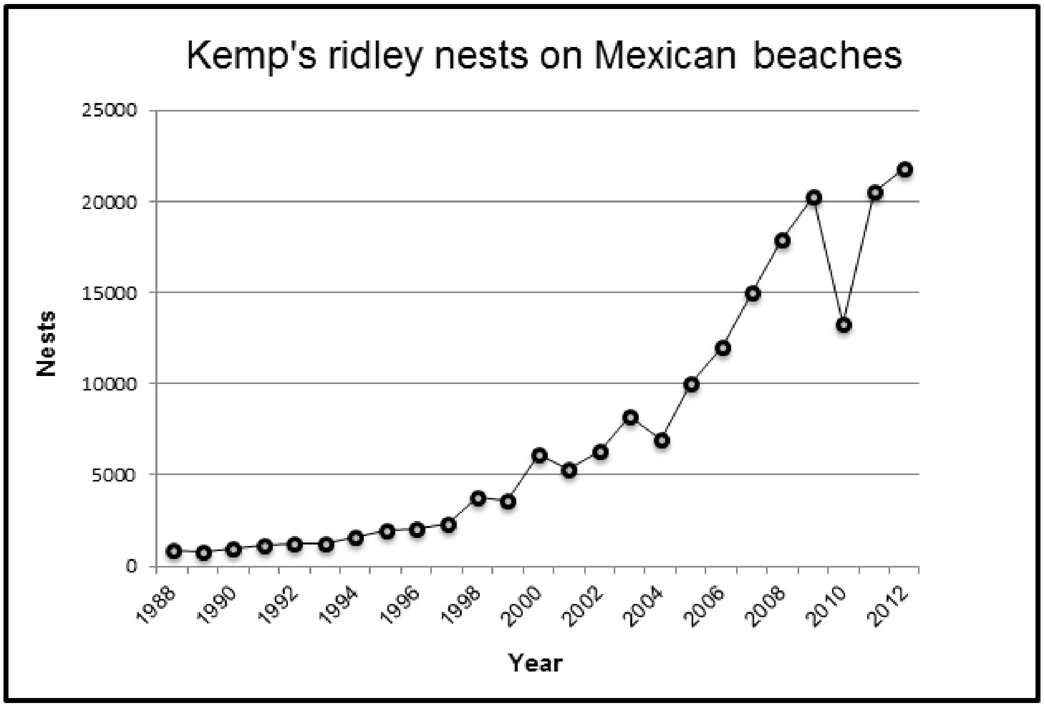

Figure 9. Kemp's ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2013).

Heppell et al. (2005) predicted in a population model that the population is expected to increase at least 12-16% per year and that the population could attain at least 10,000 females nesting on Mexico beaches by 2015. NMFS et al. (2011) produced an updated model that predicted the population to increase 19% per year and 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. While counts did not reach 25,000 nests by 2012, it is clear that the population is steadily increasing. 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 United States, 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 randomness, all of which are often difficult to predict with any certainty.

Threats

Kemp's ridley sea turtles face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 3.2.1; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact Kemp's ridley sea turtles.

As Kemp's ridley sea turtles continue to recover and nesting arribadas[15] are increasingly established, bacterial and fungal pathogens in nests are also likely to increase. Bacterial and fungal pathogen impacts have been well documented in the large arribadas of the olive ridley at Nancite in Costa Rica (Mo 1988). In some years, and on some sections of the beach, the hatching success can be as low as five % (Mo 1988). As the Kemp's ridley nest density at Rancho Nuevo and adjacent beaches continues to increase, appropriate monitoring of emergence success will be necessary to determine if there are any density dependent effects on emergence success.

Over the past three years, NMFS has documented (via the Sea Turtle Stranding and Salvage Network data, http://www.sefsc.noaa.gov/species/turtles/strandings.htm) 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 644 sea turtle strandings were reported in 2010 from Louisiana, Mississippi, and Alabama waters, 561 (87%) of which were Kemp's ridley sea turtles. During March through May of 2011, 267 sea turtle strandings were reported from Mississippi and Alabama waters alone. A total of 525 sea turtle strandings were reported in 2011 from Louisiana, Mississippi, and Alabama waters, with the majority (455) occurring from March through July, 390 (86%) of which were Kemp's ridley sea turtles. During 2012, a total of 428 sea turtles were reported from Louisiana, Mississippi, and Alabama waters, though the data is incomplete. Of these reported strandings, 301 (70%) were Kemp's ridley sea turtles. These stranding numbers are significantly greater than reported in past years; 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. Nonetheless, considering that strandings typically represent only a small fraction of actual mortality, these stranding events potentially represent a serious impact to the recovery and survival of the local sea turtle populations. While a definitive cause for these strandings has not been identified, necropsy results indicate a significant number of stranded turtles from these events likely perished due to forced submergence, which is commonly associated with fishery interactions (B. Stacy, NMFS, pers. comm. to M. Barnette, NMFS, March 2012). Yet, available information indicates fishery effort was extremely limited during the stranding events. The fact that in both 2010 and 2011 approximately 85% of all Louisiana, Mississippi, and Alabama stranded sea turtles were Kemp's ridleys is notable; however, this could simply be a function of the species' preference for shallow, inshore waters coupled with increased population abundance as reflected in recent Kemp's ridley nesting increases.

In response to these strandings, and due to speculation that fishery interactions may be the cause, fishery observer effort was shifted to evaluate the inshore skimmer trawl fishery during the summer of 2012. During May-July, observers reported 24 sea turtle interactions in the skimmer trawl fishery, all but one of which were identified as Kemp's ridleys (one sea turtle was an unidentified hardshell turtle). Encountered sea turtles were all very small, juvenile specimens

[15] Arribada is the Spanish word for "arrival" and is the term used for massive synchronized nesting within the genus *Lepidochelys.*

ranging from 7.6-19.0 in (19.4-48.3 cm) CCL, and all sea turtles were released alive. The small average size of encountered Kemp's ridleys introduces a potential conservation issue, as over 50% of these reported sea turtles could potentially pass through the maximum 4-inch bar spacing of TEDs currently required in the shrimp fishery. Due to this issue, a proposed 2012 rule to require TEDs in the skimmer trawl fishery (77 FR 27411) was not implemented. Based on anecdotal information, these interactions were a relatively new issue for the inshore skimmer trawl fishery. Given the nesting trends and habitat utilization of Kemp's ridley sea turtles, it is likely that fishery interactions in the Northern Gulf of Mexico may continue to be an issue of concern for the species, and one that may potentially slow the rate of recovery for Kemp's ridley sea turtles.

3.2.6 Smalltooth Sawfish (U.S. DPS)

The U.S. DPS of smalltooth sawfish was listed as endangered under the ESA effective May 1, 2003 (68 FR 15674, April 1, 2003).

Species Description and Distribution
The smalltooth sawfish is a tropical marine and estuarine elasmobranchs. It has an extended snout with a long, narrow, flattened, rostral blade (rostrum) with a series of transverse teeth along either edge. In general, smalltooth sawfish inhabit shallow coastal waters of warm seas throughout the world and feed on a variety of small fish, e.g., mullet, jacks, and ladyfish (Simpfendorfer 2001), and crustaceans, e.g., shrimp and crabs (Bigelow and Schroeder 1953; Norman and Fraser 1937).

Although this species is reported to have a circumtropical distribution, NMFS identified smalltooth sawfish from the Southeast United States as a distinct population segment (DPS), due to the physical isolation of this population from others, the differences in international management of the species, and the significance of the U.S. population in relation to the global range of the species (see 68 FR15674). Within the United States, smalltooth sawfish have been captured in estuarine and coastal waters from New York southward through Texas, although peninsular Florida has historically been the region of the United States with the largest number of recorded captures (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 is also the last U.S. stronghold for the species (Poulakis and Seitz 2004; Seitz and Poulakis 2002; Simpfendorfer and Wiley 2005). Water temperatures (no lower than 16°-18°C) and the availability of appropriate coastal habitat (shallow, euryhaline waters and red mangroves) are the major environmental constraints limiting the northern movements of smalltooth sawfish in the western North Atlantic. Most specimens captured along the Atlantic coast north of Florida are large adults (over 10 feet) that likely represent seasonal migrants, wanderers, or colonizers from a historic Florida core population(s) to the south, rather than being members of a continuous, even-density population (Bigelow and Schroeder 1953).

Life History Information
Smalltooth sawfish fertilization is internal and females give birth to live young. The brood size, gestation period, and frequency of reproduction are unknown for smalltooth sawfish. Therefore, data from the closely related (in terms of size and body morphology) largetooth sawfish

represent our best estimates of these parameters. The largetooth sawfish likely reproduces every other year, has a gestation period of approximately 5 months, and produces a mean of 7.3 offspring per brood [range of 1-13 offspring; (Thorson 1976])]. Smalltooth sawfish are approximately 31 in (80 cm) at birth and may grow to a length of 18 ft (548 cm) or greater during their lifetime (Bigelow and Schroeder 1953; Simpfendorfer 2002). Simpfendorfer et al. (2008) report rapid juvenile growth for smalltooth sawfish for the first two years after birth, with stretched total length increasing by an average of 25-33 in (65-85 cm) in the first year and an average of 19-27 in (48-68 cm) in the second year. However, very little information exists on size classes other than juveniles, which make up the majority of sawfish encounters; therefore, much uncertainty remains in estimating life history parameters for smalltooth sawfish, especially as it relates to age at maturity and post-juvenile growth rates. Based on age and growth studies of the largetooth sawfish (Thorson 1982) and research by Simpfendorfer (2000), the smalltooth sawfish is likely a slow-growing (with the exception of early juveniles), late-maturing (10-20 years) species with a long lifespan (30-60 years). Juvenile growth rates presented by Simpfendorfer et al. (2008) suggest smalltooth sawfish are growing faster than previously thought and therefore may reach sexual maturity at an earlier age.

There are distinct differences in habitat use based on life history stage. Juvenile smalltooth sawfish (those up to 3 years of age or approximately 8 ft in length [Simpfendorfer et al. 2008]) inhabit the shallow waters of estuaries and can be found in sheltered bays, dredged canals, along banks and sandbars, and in rivers (NMFS 2000). Juvenile smalltooth sawfish occur in euryhaline waters (i.e., waters with a wide range of salinities) and are often closely associated with muddy or sandy substrates, and shorelines containing red mangroves, *Rhizophora mangle* (Simpfendorfer 2001; Simpfendorfer 2003). Tracking data from the Caloosahatchee River in Florida indicate very shallow depths and salinity are important abiotic factors influencing juvenile smalltooth sawfish movement patterns, habitat use, and distribution (Simpfendorfer 2011). Another recent acoustic tagging study in a developed region of Charlotte Harbor, Florida identified the importance of mangroves in close proximity to shallow water habitat for juvenile smalltooth sawfish, stating that juveniles generally occur in shallow water within 328 ft (100 m) of mangrove shorelines (generally red mangroves [Simpfendorfer et al. 2010]). Juvenile smalltooth sawfish spend the majority of their time in waters less than 13 ft (4 m) in depth (Simpfendorfer et al. 2010) and are seldom found in depths greater than 32 ft (10 m; [Poulakis and Seitz 2004]). Simpfendorfer et al. (2010) also indicated developmental differences in habitat use: the smallest juveniles (young-of-the-year juveniles measuring <100 cm in length) generally used water depths less than 0.5 m (1.64 ft), had small home ranges (4,264 to 4,557 sq m), and exhibited high levels of site fidelity. Although small juveniles exhibit high levels of site fidelity for specific nursery habitats for periods of time lasting up to three months (Wiley 2007), they do undergo small movements coinciding with changing tidal stages. These movements often involve moving from shallow sandbars at low tide to within red mangrove prop roots at higher tides (Simpfendorfer et al. 2010), behavior likely to reduce the risk of predation (Simpfendorfer 2006). As juveniles increase in size, they begin to expand their home ranges (Simpfendorfer et al. 2010; Simpfendorfer et al. 2011), eventually moving to more offshore habitats where they likely feed on larger prey and eventually reach sexual maturity.

Researchers have identified several areas within the Charlotte Harbor Estuary that are disproportionately more important to juvenile smalltooth sawfish, based on intra- or inter-annual (within or between year) capture rates during random sampling events within the estuary (Poulakis 2012; Poulakis et al. 2011). These areas were termed "hotspots" and also correspond with areas where public encounters are most frequently reported. Use of these "hotspots" can vary within and among years based on the amount and timing of freshwater inflow. Smalltooth sawfish use hotspots further upriver during high salinity conditions (drought) and areas closer to the mouth of the Caloosahatchee River during times of high freshwater inflow (Poulakis et al. 2011). At this time, researchers are unsure what specific biotic or abiotic factors (e.g., presence or absence of predators and prey) influence this habitat use, but we believe a variety of conditions in addition to salinity, such as temperature, dissolved oxygen, water depth, shoreline vegetation, and food availability, may influence habitat selection (Poulakis et al. 2011).

While adult smalltooth sawfish may also use the estuarine habitats used by juveniles, they are commonly observed in deeper waters along the coasts. Poulakis and Seitz (2004) noted that nearly half of the encounters with adult-sized smalltooth sawfish in Florida Bay and the Florida Keys occurred in depths from 200 to 400 ft (70 to 122 m) of water. Similarly, Simpfendorfer and Wiley (2005) reported encounters in deeper waters off the Florida Keys, and observations from both commercial longline fishing vessels and fishery-independent sampling in the Florida Straits report large smalltooth sawfish in depths up to 130 ft (~40 m) (NSED 2012). However, NMFS believes adult smalltooth sawfish use shallow estuarine habitats during parturition (when adult females return to shallow estuaries to pup) because very young juveniles still containing rostral sheaths are captured in these areas. Since very young juveniles have high site fidelities, we hypothesize that they are birthed nearby or in their nursery habitats.

Status and Population Dynamics

Few long-term abundance data exist for the smalltooth sawfish, making it very difficult to estimate the current population size. Simpfendorfer (2001) estimated that the U.S. population may number less than 5% of historic levels, based on anecdotal data and the fact that the species' range has contracted by nearly 90%, with south and southwest Florida the only areas known to support a reproducing population. Since actual abundance data are limited, researchers have begun to compile capture and sightings data (collectively referred to as encounter data) in the National Sawfish Encounter Database (NSED) that was developed in 2000. Although this data cannot be used to assess the population because of the opportunistic nature in which they are collected (i.e., encounter data are a series of random occurrences rather than an evenly distributed search over a defined period of time), researchers can use this database to assess the spatial and temporal distribution of smalltooth sawfish. We expect that as the population grows, the geographic range of encounters will also increase. Since the conception of the NSED, over 3,000 smalltooth sawfish encounters have been reported and compiled in the encounter database (NSED 2012).

Despite the lack of scientific data on abundance, recent encounters with young-of-the-year, older juveniles, and sexually mature smalltooth sawfish indicate that the U.S. 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-dependent monitoring program (angler interviews) indicate a slightly increasing trend in abundance within the park over the past decade (Carlson and Osborne 2012;

Carlson et al. 2007). 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 population doubling times from 5.4 to 8.5 years. These low intrinsic rates[16] of population increase, suggest that the species is particularly vulnerable to excessive mortality and rapid population declines, after which recovery may take decades.

Threats

Past literature indicates smalltooth sawfish were once abundant along both coasts of Florida and quite common along the shores of Texas and the northern Gulf coast [(NMFS 2010) and citations therein]. Based on recent comparisons with these historical reports, the U.S. DPS of smalltooth sawfish has declined over the past century (e.g., [Simpfendorfer 2001; Simpfendorfer 2002]). The decline in smalltooth sawfish abundance has been attributed to several factors including bycatch mortality in fisheries, habitat loss, and life history limitations of the species (NMFS 2010).

<u>Bycatch Mortality</u>

Bycatch mortality is cited as the primary cause for the decline in smalltooth sawfish in the United States (NMFS 2010). While there has never been a large-scale directed fishery, smalltooth sawfish easily become entangled in fishing gears (gillnets, otter trawls, trammel nets, and seines) directed at other commercial species, often resulting in serious injury or death (NMFS 2009). This has historically been reported in Florida (Snelson and Williams 1981), Louisiana (Simpfendorfer 2002), and Texas (Baughman 1943). For instance, one fisherman interviewed by Evermann and Bean (1898) reported taking an estimated 300 smalltooth sawfish in just one netting season in the Indian River Lagoon, Florida. In another example, smalltooth sawfish landings data gathered by Louisiana shrimp trawlers from 1945-1978, which contained both landings data and crude information on effort (number of vessels, vessel tonnage, number of gear units), indicated declines in smalltooth sawfish landings from a high of 34,900 pounds in 1949 to less than 1,500 pounds in most years after 1967. The Florida net ban passed in 1995 has led to a reduction in the number of smalltooth sawfish incidentally captured, "…by prohibiting the use of gill and other entangling nets in all Florida waters, and prohibiting the use of other nets larger than 500 square feet in mesh area in nearshore and inshore Florida waters[17]" (FLA. CONST. art. X, § 16). However, the threat of bycatch currently remains in commercial fisheries (e.g., South Atlantic shrimp fishery, Gulf of Mexico shrimp fishery, federal shark fisheries of the South Atlantic, and the Gulf of Mexico reef fish fishery), though anecdotal information collected by NMFS's port agents suggest smalltooth sawfish captures are now rare.

In addition to incidental bycatch in commercial fisheries, smalltooth sawfish have historically been and continue to be captured by recreational fishermen. Encounter data (NSED 2012) and past research (Caldwell 1990) document that rostrums are sometimes removed from smalltooth sawfish caught by recreational fishermen, thereby reducing their chances of survival. While the

[16] The rate at which a population increases in size if there are no density-dependent forces regulating the population

[17] "nearshore and inshore Florida waters" means all Florida waters inside a line three miles seaward of the coastline along the Gulf of Mexico and inside a line one mile seaward of the coastline along the Atlantic Ocean.

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 recreational fisheries remains a potential threat to the species.

Habitat Loss

Modification and loss of smalltooth sawfish habitat, especially nursery habitat, is another contributing factor in the decline of the species. 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). Large areas of coastal habitat were modified or lost between the mid-1970s and mid-1980s within the United States (Dahl and Johnson 1991). Since then, rates of loss have decreased, but habitat loss continues. From 1998-2004, approximately 64,560 acres of coastal wetlands were lost along the Atlantic and Gulf coasts of the United States, of which approximately 2,450 acres were intertidal wetlands consisting of mangroves or other estuarine shrubs (Stedman and Dahl 2008). Further, Orlando et al. (1994) analyzed 18 major southeastern estuaries and recorded over 703 miles of navigation channels and 9,844 miles of shoreline with modifications. In Florida, coastal development often involves the removal of mangroves and the armoring of shorelines through seawall construction. Changes to the natural freshwater flows into estuarine and marine waters through construction of canals and other water control devices have also altered the temperature, salinity, and nutrient regimes; reduced both wetlands and submerged aquatic vegetation; and degraded vast areas of coastal habitat utilized by smalltooth sawfish (Gilmore 1995; Reddering 1988; Whitfield and Bruton 1989). While these modifications of habitat are not the primary reason for the decline of smalltooth sawfish abundance, it is likely a contributing factor and almost certainly hampers the recovery of the species. Juvenile sawfish and their nursery habitats are particularly likely to be affected by these kinds of habitat losses or alternations, due to their affinity for shallow, estuarine systems. Although many forms of habitat modification are currently regulated, some permitted direct and/or indirect damage to habitat from increased urbanization still occurs and is expected to continue to threaten survival and recovery of the species in the future.

Life History Limitations

The smalltooth sawfish is also limited by its life history characteristics as a slow-growing, relatively late-maturing, and long-lived species. Animals using this life history strategy are usually successful in maintaining small, persistent population sizes in constant environments, but are particularly vulnerable to increases in mortality or rapid environmental change (NMFS 2000). The combined characteristics of this life history strategy result in a very low intrinsic rate of population increase (Musick 1999) that make it slow to recover from any significant population decline (Simpfendorfer 2000). More recent data suggest smalltooth sawfish may mature earlier than previously thought, meaning rates of population increase could be higher and recovery times shorter than those currently reported (Simpfendorfer et al. 2008).

Current Threats

The three major factors that led to the current status of the U.S. DPS of smalltooth sawfish (bycatch mortality, habitat loss, and life history limitations) continue to be the greatest threats today. All the same, other threats such as the illegal commercial trade of smalltooth sawfish or their body parts, predation, and marine pollution and debris may also affect the population and recovery of smalltooth sawfish on smaller scales (NMFS 2010). We anticipate that all of these threats will continue to affect the rate of recovery for the U.S. DPS of smalltooth sawfish.

In addition to the anthropogenic effects mentioned previously, changes to the global climate are likely to be a threat to smalltooth sawfish and the habitats they use. The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts to coastal resources may be significant. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, changes in the amount and timing of precipitation, and changes in air and water temperatures (e.g., EPA 2012; NOAA 2012). The impacts to smalltooth sawfish cannot, for the most part, currently be predicted with any degree of certainty, but we can project some effects to the coastal habitats where they reside. We know that the coastal habitats that contain red mangroves and shallow, euryhaline waters will be directly impacted by climate change through sea level rise, which is expected to exceed 1 meter globally by 2100 according to Meehl et al. (2007), Pfeffer et al. (2008), and Vermeer and Rahmstorf (2009). Sea level rise will impact mangrove resources, as sediment surface elevations for mangroves will not keep pace with conservative projected rates of elevation in sea level (Gilman et al. 2008). Sea level increases will also affect the amount of shallow water available for juvenile smalltooth sawfish nursery habitat, especially in areas where there is shoreline armoring (e.g., seawalls). Further, the changes in precipitation coupled with sea level rise may also alter salinities of coastal habitats, reducing the amount of available smalltooth sawfish nursery habitat.

3.2.7 Atlantic Sturgeon

Five separate DPSs of Atlantic sturgeon were listed under the ESA by NMFS effective April 6, 2012 (77 FR 5880 and 5914, February 6, 2012). The New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs were listed as endangered. The Gulf of Maine DPS was listed as threatened.

Species Descriptions and Distributions
Atlantic sturgeon are long-lived, late-maturing, estuarine-dependent, anadromous fish distributed along the eastern coast of North America (Waldman and Wirgin 1998). Historically, sightings have been reported from Hamilton Inlet, Labrador, south to the St. Johns River, Florida (Murawski et al. 1977; Smith and Clugston 1997). Atlantic sturgeon may live up to 60 years, reach lengths up to 14 ft, and weigh over 800 lb (ASSRT 2007; Collette and Klein-MacPhee 2002). They are distinguished by armor-like plates (called scutes) and a long protruding snout that has four barbels (slender, whisker-like feelers extending from the head used for touch and taste). Atlantic sturgeon spend the majority of their lives in nearshore marine waters, returning to their natal rivers to spawn (Wirgin et al. 2002). Young sturgeon may spend the first few years of life in their natal river estuary before moving out to sea (Wirgin et al. 2002). Sturgeon are omnivorous benthic (bottom) feeders and filter quantities of mud along with their food. Adult sturgeon diets include mollusks, gastropods, amphipods, isopods, and fish. Juvenile sturgeon feed on aquatic insects and other invertebrates (Smith 1985b).

Historically, Atlantic sturgeon were present in approximately 38 rivers in the United States from Saint Croix, Maine to the Saint Johns River, Florida, of which 35 rivers have been confirmed to have had a historical spawning population. Atlantic sturgeon are currently present in approximately 32 of these rivers, and spawning occurs in at least 20 of them. The marine range of Atlantic sturgeon extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. Because adult Atlantic sturgeon from all DPSs mix extensively in marine waters, we expect fish from all DPSs to be found in the action area.

Life History Information
Atlantic sturgeon populations show clinal variation, with a general trend of faster growth and earlier age at maturity 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). Most Atlantic sturgeon adults likely do not spawn every year. Multiple studies have shown that spawning intervals range from 1 to 5 years for males (Caron et al. 2002; Collins et al. 2000b; Smith 1985a) and 2 to 5 years for females (Stevenson and Secor 1999; Van Eenennaam et al. 1996; Vladykov and Greely 1963). 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 (Dadswell 2006; Smith et al. 1982; Van Eenennaam and Doroshov 1998). The average age at which 50% 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).

Spawning adult Atlantic sturgeon generally migrate upriver in spring/early summer, which occurs in February-March in southern systems, April-May in Mid-Atlantic systems, and May-July in Canadian systems (Bain 1997; Caron et al. 2002; Murawski et al. 1977; Smith 1985a; Smith and Clugston 1997). In some southern rivers, a fall spawning migration may also occur (Moser et al. 1998; Rogers and Weber 1995; Weber and Jennings 1996). Atlantic sturgeon spawning occurs in fast flowing water between the salt front and fall line of large rivers (Bain et al. 2000; Borodin 1925; Crance 1987; Leland 1968; Scott and Crossman 1973) over hard substrate, such as cobble, gravel, or boulders, which the highly adhesive sturgeon eggs adhere to (Gilbert 1989; Smith and Clugston 1997). Hatching occurs approximately 94-140 hours after egg deposition and larvae assume a demersal existence (Smith et al. 1980). The yolk sac larval stage is completed in about 8-12 days, during which time the larvae move downstream to rearing grounds (Kynard and Horgan 2002). During the first half of their migration downstream, movement is limited to night. During the day, larvae use benthic structure (e.g., gravel matrix) as refugia (Kynard and Horgan 2002). During the latter half of migration when larvae are more fully developed, movement to rearing grounds occurs both day and night. Juvenile sturgeon continue to move further downstream into brackish waters, and eventually become residents in estuarine waters for months or years.

Juvenile and adult Atlantic sturgeon occupy 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 (Schueller and Peterson 2010; Smith 1985a), 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 (Kieffer and Kynard 1993; Smith 1985a). In Georgia and South Carolina, this begins in February or March (Collins et al. 2000a). Males commence upstream migration to the spawning sites when waters reach around 6°C (Dovel and Berggren 1983; Smith 1985a; Smith et al. 1982) with females following a few weeks later when water temperatures are closer to 12° or 13°C (Collins et al. 2000a; Dovel and Berggren 1983; Smith 1985a). In some rivers, predominantly in the south, a fall spawning migration may also occur (Moser et al. 1998; Rogers and Weber 1995), with running ripe males found August through October and post-spawning females captured in late September and October (Collins et al. 2000b).

Status and Population Dynamics

At the time Atlantic sturgeon were listed, the best available abundance information for each of the 5 DPSs was the estimated number of adult Atlantic sturgeon spawning in each of the rivers on an annual basis. The estimated number of annually spawning adults in each of the river populations is insufficient to quantify the total population numbers for each DPS of Atlantic sturgeon due to the lack of other necessary accompanying life history data. A recent Atlantic sturgeon population estimate was derived from the Northeast Area Monitoring and Assessment Program (NEAMAP). NEAMAP trawl surveys were conducted from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina, in nearshore waters to depths of 60 ft from fall 2007 through spring 2012. The results of these surveys, assuming 50% gear efficiency (i.e., assumption that the gear will capture some, but not all, of the sturgeon in the water column along the tow path, and the survey area is only a portion of Atlantic sturgeon habitat), are presented in Table 6. It is important to note that the NEAMAP surveys were conducted primarily in the Northeast and may underestimate the actual population abundances of the Carolina and South Atlantic DPSs, which are likely more concentrated in the Southeast since they originated from and spawn there. However, the total ocean population abundance estimates listed in Table 6 currently represent the best available population abundance estimates for the 5 U.S. Atlantic sturgeon DPSs.

Table 6. Summary of calculated population estimates based upon the NEAMAP Survey swept area assuming 50% efficiency (NMFS 2013).

DPS	Estimated Ocean Population Abundance	Estimated Ocean Population of Adults	Estimated Ocean Population of Subadults (of size vulnerable to capture in fisheries)
South Atlantic	14,911	3,728	11,183
Carolina	1,356	339	1,017
Chesapeake Bay	8,811	2,203	6,608
New York Bight	34,566	8,642	25,925
Gulf of Maine	7,455	1,864	5,591

Canada	678	170	509

South Atlantic DPS

The South Atlantic DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) of the Ashepoo, Combahee, and Edisto River (ACE) Basins southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. Rivers known to have current spawning populations within the range of the South Atlantic DPS include the Combahee, Edisto, Savannah, Ogeechee, Altamaha, and Satilla Rivers. We determined spawning was occurring if young-of-the-year (YOY) were observed, or mature adults were present, in freshwater portions of a system. However, 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.

Historically, both the Broad-Coosawatchie and St. Marys Rivers were documented to have spawning populations; there is also evidence that spawning may have occurred in the St. Johns River or one of its tributaries. However, the spawning population in the St. Marys River, as well as any historical spawning population in the St. Johns, is believed to be extirpated, and the status of the spawning population in the Broad-Coosawatchie is unknown. Both the St. Marys and St. Johns Rivers are used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. The use of the Broad-Coosawatchie by sturgeon from other spawning populations is unknown at this time. The presence of historical and current spawning populations in the Ashepoo River has not been documented; however, this river may currently be used for nursery habitat by young Atlantic sturgeon originating from other spawning populations. This represents our current knowledge of the river systems utilized by the South Atlantic DPS for specific life functions, such as spawning, nursery habitat, and foraging. However, fish from the South Atlantic DPS likely use other river systems than those listed here for their specific life functions.

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 and 8,000 adult females were present in South Carolina prior to 1890. The Altamaha River population of the South Atlantic DPS, with an estimated 343 adults spawning annually, is believed to be the largest remaining population in the Southeast, yet is estimated to be only 6% of its historical population size. The abundances of the remaining river populations within the South Atlantic DPS, each estimated to have fewer than 300 annually spawning adults, are estimated to be less than 1% of what they were historically (ASSRT 2007). The NEAMAP model estimates a minimum ocean population of 14,911 South Atlantic DPS Atlantic sturgeon, of which 3,728 are adults.

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. Rivers known to have current spawning populations within the range of the Carolina DPS include the Roanoke, Tar-Pamlico, Cape Fear, Waccamaw, and Yadkin-Pee Dee River. We determined spawning was occurring if

YOY were observed, or mature adults were present, in freshwater portions of a system. However, 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. There may also be spawning populations in the Neuse, Santee and Cooper Rivers, though it is uncertain.

Historically, both the Sampit and Ashley Rivers in South Carolina were documented to have spawning populations at one time. However, the spawning population in the Sampit River is believed to be extirpated and the current status of the spawning population in the Ashley River is unknown. Both rivers may be used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. This represents our current knowledge of the river systems utilized by the Carolina DPS for specific life functions, such as spawning, nursery habitat, and foraging. However, fish from the Carolina DPS likely use other river systems than those listed here for their specific life functions.

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 5 of 7-10 historical spawning populations remaining in the Carolina DPS. 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% of what they were historically (ASSRT 2007). The NEAMAP model estimates a minimum ocean population of 1,356 Carolina DPS Atlantic sturgeon, of which 339 are adults.

Chesapeake Bay DPS

The Chesapeake Bay DPS includes all anadromous Atlantic sturgeons 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. Within this range, Atlantic sturgeon historically spawned in the Susquehanna, Potomac, James, York, Rappahannock, and Nottoway Rivers (ASSRT 2007). Spawning still occurs in the James River, and the presence of juvenile and adult sturgeon in the York River suggests that spawning may occur there as well (ASSRT 2007; Greene et al. 2009; Musick et al. 1994). However, conclusive evidence of current spawning is available for the James River, only. Atlantic sturgeon that are spawned elsewhere are known to use waters of the Chesapeake Bay for other life functions, such as foraging and as juvenile nursery habitat, before entering the marine system as sub-adults (ASSRT 2007; Grunwald et al. 2008; Vladykov and Greely 1963; Wirgin et al. 2007).

Historically, the Chesapeake Bay DPS likely supported more than 10,000 spawning adults (ASSRT 2007; KRRMP 1993; Secor 2002). Current estimates of the Chesapeake Bay DPS from the NEAMAP model (Table 6) indicate the current number of spawning adults is likely an order of magnitude lower than historical levels (ASSRT 2007; Kahnle et al. 2007). The NEAMAP model estimates a minimum ocean population of 8,811 Chesapeake Bay DPS Atlantic sturgeon, of which 2,319 are adults.

New York Bight DPS

The New York Bight DPS includes all anadromous Atlantic sturgeon that spawn in the watersheds that drain into coastal waters from Chatham, Massachusetts, to the Delaware-Maryland border on Fenwick Island. Within this range, Atlantic sturgeon historically spawned in the Connecticut, Delaware, Hudson, and Taunton Rivers (ASSRT 2007; Murawski et al. 1977; Secor 2002). Spawning still occurs in the Delaware and Hudson Rivers, but there is no recent evidence (within the last 15 years) of spawning in the Connecticut and Taunton Rivers (ASSRT 2007). Atlantic sturgeon that are spawned elsewhere continue to use habitats within the Connecticut and Taunton Rivers for other life functions (ASSRT 2007; Savoy 2007; Wirgin and King 2011).

Prior to the onset of expanded fisheries exploitation of sturgeon in the 1800s, a conservative historical estimate for the Hudson River Atlantic sturgeon population was 10,000 adult females (Secor 2002). Current population abundance is likely at least one order of magnitude smaller than historical levels (ASSRT 2007; Kahnle et al. 2007; Secor 2002). Based on data collected from 1985–1995, there are 870 spawning adults per year in the Hudson River (Kahnle et al. 2007). Kahnle (2007; 1998) also showed that the level of fishing mortality from the Hudson River Atlantic sturgeon fishery during the period of 1985-1995 exceeded the estimated sustainable level of fishing mortality for the riverine population, and may have led to reduced recruitment. All available data on abundance of juvenile Atlantic sturgeon in the Hudson River Estuary indicate a substantial drop in production of young since the mid-1970s (Kahnle et al. 1998). A decline appeared to occur in the mid to late 1970s followed by a secondary drop in the late 1980's (ASMFC 2010; Kahnle et al. 1998; Sweka et al. 2007). Catch-per-unit-effort (CPUE) data suggest that recruitment has remained depressed relative to catches of juvenile Atlantic sturgeon in the estuary during the mid-late 1980s (ASMFC 2010; Sweka et al. 2007). From 1985-2007, there were significant fluctuations in CPUE. The number of juveniles appears to have declined between the late 1980s and early 1990s. While the CPUE is generally higher in the 2000s as compared to the 1990s, significant annual fluctuations make it difficult to discern any trend. The CPUEs from 2000-2007 are generally higher than those from 1990-1999. However, they remain lower than the CPUEs observed in the late 1980s. There is currently not enough information regarding any life stage to establish a trend for the Hudson River population (ASMFC 2010; Sweka et al. 2007).

There is no abundance estimate for the Delaware River population of Atlantic sturgeon. Harvest records from the 1800s indicate that this was historically a large population, with an estimated 180,000 adult females prior to 1890 (Secor 2002; Secor and Waldman 1999). Fisher (2009) sampled the Delaware River in 2009 to target young-of-the-year (YOY) Atlantic sturgeon. The effort captured 34 YOY. Brundage and O’Herron (2003) also collected 32 YOY Atlantic sturgeon from the Delaware River in a separate study. Fisher (2011) reports that genetics information collected from 33 of the 2009 year class YOY indicates that at least 3 females successfully contributed to the 2009 year class. The capture of YOY in 2009 shows that successful spawning is still occurring in the Delaware River, but the relatively low numbers suggest the existing riverine population is limited in size. Similar to the Hudson River, there is currently not enough information to determine a trend for the Delaware River population. The ASSRT (2007) suggested that there may be less than 300 spawning adults per year for the Delaware River portion of the New York Bight DPS. The NEAMAP model estimates a minimum ocean population of 34,566 Atlantic sturgeon, of which 8,642 are adults.

Gulf of Maine DPS

The Gulf of Maine DPS includes all anadromous Atlantic sturgeons that are spawned in the watersheds from the Maine/Canadian border and, extending southward, all watersheds draining into the Gulf of Maine as far south as Chatham, Massachusetts. Within this range, Atlantic sturgeon historically spawned in the Androscoggin, Kennebec, Merrimack, Penobscot, and Sheepscot Rivers (ASSRT 2007). Spawning still occurs in the Kennebec and Androscoggin Rivers, and may still occur in the Penobscot River. Atlantic sturgeon continue to be present in the Kennebec River; in addition, they are captured in directed research projects in the Penobscot River. They are also observed in the Saco, Presumpscot, and Charles Rivers where they were unknown to occur before or had not been observed to occur for many years. These observations suggest that the abundance of the Gulf of Maine DPS of Atlantic sturgeon is large enough that recolonization to rivers historically suitable for spawning may be occurring.

Historically, the Gulf of Maine DPS likely supported more than 10,000 spawning adults (ASSRT 2007; KRRMP 1993; Secor 2002), suggesting the recent estimate of spawning adults within the DPS is one to two orders of magnitude smaller than historical levels (e.g., hundreds to low thousands (ASSRT 2007; Kahnle et al. 2007). The CPUE of sub-adult Atlantic sturgeon in a multifilament gillnet survey conducted on the Kennebec River was considerably greater for the period of 1998–2000 (CPUE=7.43) compared to the CPUE for the period 1977–1981 (CPUE = 0.30). The CPUE of adult Atlantic sturgeon showed a slight increase over the same time period (1977–1981 CPUE = 0.12 versus 1998–2000 CPUE = 0.21) (Squiers 2004). There is also new evidence of Atlantic sturgeon presence in rivers (e.g., the Saco River) where they have not been observed for many years. However, there is not enough information to establish a trend for this DPS. The NEAMAP model estimates a minimum ocean population of 7,455 Atlantic sturgeon, of which 1,864 are adults.

Viability of Atlantic Sturgeon DPSs

The concept of a viable population able to adapt to changing environmental conditions is critical to Atlantic sturgeon, and the low population numbers of every river population in the five DPSs on the East Coast put them in danger of extinction throughout their range. None of the riverine spawning populations are large or stable enough to provide with any level of certainty for continued existence of any of the DPSs. Although the largest impact that caused the precipitous decline of the species has been prohibited (directed fishing), the Atlantic sturgeon population sizes within each DPS have remained relatively constant at greatly reduced levels for 100 years. The largest Atlantic sturgeon population in the United States, the Hudson River population within the New York Bight DPS, is estimated to have only 870 spawning adults each year. The Altamaha River population within the South Atlantic DPS is the largest Atlantic sturgeon population in the Southeast and only has an estimated 343 adults spawning annually. All other Atlantic sturgeon river populations in the U.S. Southeast are estimated to have 300 or less spawning adults annually.

Small numbers of individuals resulting from drastic reductions in populations, such as occurred with Atlantic sturgeon due to the commercial fishery, can remove the buffer against natural demographic and environmental variability provided by large populations (Berry 1971; Shaffer 1981; Soulé 1980). Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon, and they continue to face a variety of other threats that contribute to their risk of extinction. Their late age at maturity provides more opportunities for individual Atlantic sturgeon to be removed from the population before reproducing. While a long life span allows multiple opportunities to contribute to future generations, it also increases the time frame over which exposure to the multitude of threats facing Atlantic sturgeon can occur.

The viability of the Atlantic sturgeon DPSs depends on having multiple self-sustaining riverine spawning populations and maintaining suitable habitat to support the various life functions (spawning, feeding, growth) of Atlantic sturgeon populations. Because a DPS is a group of populations, the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. The loss of any population within a DPS will result in (1) a long-term gap in the range of the DPS that is unlikely to be recolonized, (2) loss of reproducing individuals, (3) loss of genetic biodiversity, (4) potential loss of unique haplotypes, (5) potential loss of adaptive traits, (6) reduction in total number, and 7) potential for loss of population source of recruits. The loss of a population will negatively impact the persistence and viability of the DPS as a whole, as fewer than two individuals per generation spawn outside their natal rivers (King et al. 2001; Waldman et al. 2002; Wirgin et al. 2000). The persistence of individual populations, and in turn the DPS, depends on successful spawning and rearing within the freshwater habitat, the immigration into marine habitats to grow, and then the return of adults to natal rivers to spawn.

Threats

Atlantic sturgeon were once numerous along the East Coast until fisheries for their meat and caviar reduced the populations by over 90% in the late 1800s. Fishing for Atlantic sturgeon became illegal in state waters in 1998 and in remaining U.S. waters in 1999. Dams, dredging, poor water quality, and accidental catch (bycatch) by fisherman continue to threaten Atlantic sturgeon. Though Atlantic sturgeon populations appear to be increasing in some rivers, other river populations along the East Coast continue to struggle and some have been eliminated entirely. The five DPSs of Atlantic sturgeon were listed as threatened or endangered under the ESA primarily as a result of a combination of habitat restriction and modification, overutilization (i.e., being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

<u>Dams</u>

Dams for hydropower generation, flood control, and navigation adversely affect Atlantic sturgeon by impeding access to spawning, developmental, and foraging habitat, modifying free-flowing rivers to reservoirs, physically damaging fish on upstream and downstream migrations, and altering water quality in the remaining downstream portions of spawning and nursery habitat (ASSRT 2007). Attempts to minimize the impacts of dams using measures such as fish passage have not proven beneficial to Atlantic sturgeon, as they do not regularly use existing fish passage devices, which are generally designed to pass pelagic fish (i.e., those living in the water column) rather than bottom-dwelling species like sturgeon. Within the range occupied by the Carolina DPS, dams have restricted Atlantic sturgeon spawning and juvenile developmental habitat by blocking over 60% of the historical sturgeon habitat upstream of the dams in the Cape Fear and Santee-Cooper River systems. Water quality [velocity, temperature, and dissolved oxygen (DO)] downstream of these dams, as well as on the Roanoke River, has been reduced, which modifies and restricts the extent of spawning and nursery habitat for the Carolina DPS. Within the range of the New York Bight DPS, the Holyoke Dam on the Connecticut River blocks further upstream passage; however, the extent that Atlantic sturgeon would historically have used habitat upstream of Holyoke is unknown. Connectivity may be disrupted by the presence of dams on several smaller rivers in the New York Bight region. Connectivity is disrupted by the presence of dams on several rivers in the range of the Gulf of Maine DPS. Within the GOM DPS, access to historical spawning habitat is most severely impacted in the Merrimack River (ASSRT 2007). Construction of the Essex Dam blocked the migration of Atlantic sturgeon to 58% of its historically available habitat (ASSRT 2007). The extent that Atlantic sturgeon are affected by dams in the Gulf of Maine region is currently unknown. However, Atlantic sturgeon larvae have been found downstream of the Brunswick Dam in the Androscoggin River. This suggests that Atlantic sturgeon spawning may be occurring in the vicinity of at least one hydroelectric project and may be affected by it.

Dredging

Riverine, nearshore, and offshore areas are often dredged to support commercial shipping and recreational boating, construction of infrastructure, and marine mining. Environmental impacts of dredging include the direct removal/burial of prey species; turbidity/siltation effects; contaminant resuspension; noise/disturbance; alterations to hydrodynamic regime and physical habitat; and actual loss of riparian habitat (Chytalo 1996; Winger et al. 2000). According to Smith and Clugston (1997), dredging and filling impact important habitat features of Atlantic sturgeon as they disturb benthic fauna, eliminate deep holes, and alter rock substrates. In the South Atlantic DPS, maintenance dredging is currently modifying Atlantic sturgeon nursery habitat in the Savannah River. Modeling indicates that the proposed deepening of the navigation channel will result in reduced DO and upriver movement of the salt wedge, restricting spawning habitat. Dredging is also modifying nursery and foraging habitat in the St. Johns River. For the Carolina DPS, dredging in spawning and nursery grounds modifies the quality of the habitat and is further restricting the extent of available habitat in the Cape Fear and Cooper Rivers, where Atlantic sturgeon habitat has already been modified and restricted by the presence of dams. Dredging for navigational purposes is suspected of having reduced available spawning habitat for the Chesapeake Bay DPS in the James River (ASSRT 2007; Bushnoe et al. 2005; Holton and Walsh 1995). Both the Hudson and Delaware rivers have navigation channels that are maintained by dredging. Dredging is also used to maintain channels in the nearshore marine environment. Many rivers in the range of the Gulf of Maine DPS also have navigation channels that are maintained by dredging. Dredging outside of federal channels and in-water construction occurs throughout the range of the New York Bight and Gulf of Maine DPSs.

Water Quality

Atlantic sturgeon rely on a variety of water quality parameters to successfully carry out their life functions. Low DO and the presence of contaminants modify the quality of Atlantic sturgeon habitat and in some cases, restrict the extent of suitable habitat for life functions. Secor (1995) noted a correlation between low abundances of sturgeon during this century and decreasing water quality caused by increased nutrient loading and increased spatial and temporal frequency of hypoxic (low oxygen) conditions. Of particular concern is the high occurrence of low DO coupled with high temperatures in the river systems throughout the range of the Carolina and South Atlantic DPSs in the Southeast. Sturgeon are more highly sensitive to low DO than other fish species (Niklitschek and Secor 2009a; Niklitschek and Secor 2009b) and low DO in combination with high temperature is particularly problematic for Atlantic sturgeon. Studies have shown that juvenile Atlantic sturgeon experience lethal and sublethal (metabolic, growth, feeding) effects as DO drops and temperatures rise (Niklitschek and Secor 2005; Niklitschek and Secor 2009a; Niklitschek and Secor 2009b; Secor and Gunderson 1998).

Reductions in water quality from terrestrial activities have modified habitat utilized by the South Atlantic DPS. Low DO is modifying sturgeon habitat in the Savannah due to dredging, and non-point source inputs are causing low DO in the Ogeechee River and in the St. Marys River which completely eliminates juvenile nursery habitat in summer. Low DO has also been observed in the St. Johns River in the summer. In the Pamlico and Neuse systems occupied by the Carolina DPS, nutrient-loading and seasonal anoxia are occurring, associated in part with concentrated animal feeding operations (CAFOs). Heavy industrial development and CAFOs have degraded water quality in the Cape Fear River. Water quality in the Waccamaw and Yadkin-Pee Dee Rivers has been affected by industrialization and riverine sediment samples contain high levels of various toxins, including dioxins. Decreased water quality also threatens Atlantic sturgeon of the Chesapeake Bay DPS, especially since the Chesapeake Bay system is vulnerable to the effects of nutrient enrichment due to a relatively low tidal exchange and flushing rate, large surface to volume ratio, and strong stratification during the spring and summer months (ASMFC 1998; ASSRT 2007; Pyzik et al. 2004). These conditions contribute to reductions in dissolved oxygen levels throughout the bay. The availability of nursery habitat, in particular, may be limited given the recurrent hypoxia (low dissolved oxygen) conditions within the Bay (Niklitschek and Secor 2005; Niklitschek and Secor 2010). Both the Hudson and Delaware rivers, as well as other rivers in the New York Bight region, were heavily polluted in the past from industrial and sewer discharges. Many rivers in Maine, including the Androscoggin River, were heavily polluted in the past from industrial discharges from pulp and paper mills. While water quality has improved and most discharges are limited through regulations, many pollutants persist in the benthic environment of the New York Bight and Gulf of Maine DPSs. This can be particularly problematic if pollutants are present on spawning and nursery grounds as developing eggs and larvae are particularly susceptible to exposure to contaminants.

Water Quantity

Water allocation issues are a growing threat in the Southeast and exacerbate existing water quality problems. Taking water from one basin and transferring it to another fundamentally and irreversibly alters natural water flows in both the originating and receiving basins, which can affect DO levels, temperature, and the ability of the basin of origin to assimilate pollutants (GWC 2006). Water quality within the river systems in the range of the South Atlantic and Carolina DPSs is negatively affected by large water withdrawals. Known water withdrawals of over 240 million gallons per day are permitted from the Savannah River for power generation and municipal uses. However, permits for users withdrawing less than 100,000 gallons per day are not required, so actual water withdrawals from the Savannah and other rivers within the range of the South Atlantic DPS are likely much higher. In the range of the Carolina DPS, twenty interbasin water transfers in existence prior to 1993, averaging 66.5 million gallons per day (mgd), were authorized at their maximum levels without being subjected to an evaluation for certification by the North Carolina Department of Environment and Natural Resources or other resource agencies. Since the 1993 legislation requiring certificates for transfers, almost 170 mgd of interbasin water withdrawals have been authorized, with an additional 60 mgd pending certification. The removal of large amounts of water from these systems will alter flows, temperature, and DO. Water shortages and "water wars" are already occurring in the rivers occupied by the South Atlantic and Carolina DPSs and will likely be compounded in the future by population growth and potentially by climate change.

Climate Change

The Intergovernmental Panel on Climate Change (IPCC) projects with high confidence that higher water temperatures and changes in extremes, including floods and droughts, will affect water quality and exacerbate many forms of water pollution—from sediments, nutrients, dissolved organic carbon, pathogens, pesticides, and salt, as well as thermal pollution, with possible negative impacts on ecosystems (IPCC 2008). In addition, sea level rise is projected to extend areas of salinization of groundwater and estuaries, resulting in a decrease of freshwater availability for humans and ecosystems in coastal areas. Some of the most populated areas are low-lying, and the threat of salt water entering into its aquifers with projected sea level rise is a concern (USGRG 2004). Existing water allocation issues would be exacerbated, leading to an increase in reliance on interbasin water transfers to meet municipal water needs, further stressing water quality. Dams, dredging, and poor water quality have already modified and restricted the extent of suitable habitat for Atlantic sturgeon spawning and nursery habitat. Changes in water availability (depth and velocities) and water quality (temperature, salinity, DO, contaminants, etc.) in rivers and coastal waters inhabited by Atlantic sturgeon resulting from climate change will further modify and restrict the extent of suitable habitat for Atlantic sturgeon. Effects could be especially harmful since these populations have already been reduced to low numbers, potentially limiting their capacity for adaptation to changing environmental conditions (Belovsky 1987; Salwasser et al. 1984; Soulé 1987; Thomas 1990).

The effects of changes in water quality (temperature, salinity, dissolved oxygen, contaminants, etc.) in rivers and coastal waters inhabited by Atlantic sturgeon are expected to be more severe for those populations that occur at the southern extreme of the Atlantic sturgeon's range, and in areas that are already subject to poor water quality as a result of eutrophication. The South Atlantic and Carolina DPSs are within a region the IPCC predicts will experience overall climatic drying (IPCC 2008). Atlantic sturgeon from these DPSs are already susceptible to reduced water quality resulting from inputs of nutrients; contaminants from industrial activities and non-point sources; and interbasin transfers of water. In a simulation of the effects of water temperature on available Atlantic sturgeon habitat in Chesapeake Bay, Niklitschek and Secor (2005) found that a 1°C increase of water temperature in the bay would reduce available sturgeon habitat by 65%.

Vessel Strikes

Vessel strikes are a threat to the Chesapeake Bay and New York Bight DPSs. Eleven Atlantic sturgeon were reported to have been struck by vessels on the James River from 2005 through

2007. Several of these were mature individuals. From 2004-2008, 29 mortalities believed to be the result of vessel strikes were documented in the Delaware River, at least 13 of these fish were large adults. The time of year when these events occurred (predominantly May through July, with two in August), indicate the animals were likely adults migrating through the river to the spawning grounds. Because we do not know the% of total vessel strikes that these observed mortalities represent, we are not able to quantify the number of individuals likely killed as a result of vessel strikes in the Chesapeake and New York Bight DPSs.

<u>Bycatch Mortality</u>
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 Atlantic sturgeon in all 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 reproductive rates, 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% of their population to bycatch mortality without suffering population declines. Mortality rates of Atlantic sturgeon taken as bycatch in various types of fishing gear range between 0 and 51%, with the greatest mortality occurring in sturgeon caught by sink gillnets. Currently, there are estimates of the number of Atlantic sturgeon captured and killed in sink gillnet and otter trawl fisheries authorized by FMPs in the Northeast Region (Miller and Shepherd 2011). Those estimates indicate from 2006-2010, on average there were 1,548 and 1,569 encounters per year in observed gillnet and trawl fisheries, respectively, with an average of 3,118 encounters combined annually. Mortality rates in gillnet gear were approximately 20% while mortality rates in otter trawl gear are generally lower, at approximately 5%. 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. Atlantic sturgeon are incidentally captured in state and federal fisheries, reducing survivorship of sub-adult and adult Atlantic sturgeon (ASMFC 2007; Stein et al. 2004). Little data exists on bycatch in the Southeast and high levels of bycatch underreporting are suspected. 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 increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins and low DO). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

3.2.8 Gulf Sturgeon

Gulf sturgeon (*Acipenser oxyrinchus desotoi)* were listed as threatened effective October 30, 1991 (56 CFR 49653, September 30, 1991), 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 (USFWS) jointly manage Gulf sturgeon. In riverine habitats, USFWS is responsible for all consultations regarding Gulf sturgeon and critical habitat. In estuarine habitats, responsibility is divided based on the action agency involved. USFWS consults with the Department of Transportation, the Environmental Protection Agency, the U.S. Coast Guard, and the Federal Emergency Management Agency; NMFS consults with the Department of Defense, U.S. Army Corps of Engineers, Bureau of Ocean Energy Management, and any other Federal agencies not specifically mentioned at 50 CFR 226.214. In marine areas, NMFS is responsible for all consultations regarding Gulf sturgeon and critical habitat. In 2009, NMFS and USFWS conducted a 5-year review and found Gulf sturgeon continued to meet the definition of a threatened species (USFWS and NMFS 2009).

Species Description and Distribution

The Gulf sturgeon is a subspecies of the Atlantic sturgeon (*A.o.oxyrinchus*). Gulf sturgeon are nearly cylindrical fish with an extended snout, vertical mouth, five rows of scutes (bony plates surrounding the body), four chin barbels (slender, whisker-like feelers extending from the head used for touch and taste), and a heterocercal (upper lobe is longer than lower) caudal fin (tail fin). Adults range from 6-8 feet in length and weigh up to 200 pounds; females grow larger than males. Gulf sturgeon spawn in freshwater and then migrate to feed and grow in estuarine/marine (brackish/salt) waters. Large sub-adults and adults feed primarily on lancelets, brachiopods, amphipods and other crustaceans, polychaetes, and gastropods. Small Gulf sturgeons feed on benthic infauna such as amphipods, grass shrimp, isopods, oligochaetes, polychaetes, and chironomid and ceratopogonid larvae, found in the intertidal zone. Sub-adults of more than 5 kg and adults in the freshwater middle river reaches essentially fast during the summer and fall (Mason and Clugston 2011).

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 (Reynolds 1993; Wooley and Crateau 1985). The subspecies' present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi respectively, east to the Suwannee River in Florida.

Life History

Gulf sturgeon are long-lived, with some individuals reaching at least 42 years in age (Huff 1975). Age at sexual maturity ranges from 8 to 17 years for females and 7 to 21 years for males (Huff 1975). Chapman and Carr (1995) estimated that mature female Gulf sturgeon weighing between 64 and 112 lb (29-51 kg) produce an average of 400,000 eggs. Spawning intervals range from 1 to 5 years for males, while females require longer intervals ranging from 3 to 5 years (Fox et al. 2000; Huff 1975).

Gulf sturgeon move from the Gulf of Mexico into coastal rivers in early spring (i.e., March through May). Fox et al (2000) found water temperatures at time of river entry differed significantly by reproductive stage and sex. Individuals entered the river system when water temperatures ranged anywhere between 11.2°C and 27.1°C. Spawning occurs in the upper reaches of rivers in the spring when water temperature is around 15^oC to 20^oC. 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 (Fox et al. 2000; Slack et al. 1999). 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 (Huff 1975; Vladykov and Greely 1963). Parauka et al. (1991) reported that hatching time for artificially spawned Gulf sturgeon ranged from 85.5 hours at 18.4°C to 54.4 hours at about 23°C. Published research on the life history of younger Gulf sturgeon is limited. After hatching, young-of-year individuals generally disperse downstream of spawning sites, though some may travel upstream as well (Clugston et al. 1995; Sulak and Clugston 1999), and move into estuarine feeding areas for the winter months.

Tagging studies confirm that Gulf sturgeon exhibit a high degree of river fidelity (Carr 1983). Of 4,100 fish tagged, 21% (860 of 4,100 fish) were later recaptured in the river of their initial collection, eight fish (0.2%) moved between river systems, and the remaining fish (78.8%) have not yet been recaptured (NMFS and USFWS 1995a). There is no information documenting the presence of spawning adults in non-natal rivers. However, there is some evidence of movements by both male and female Gulf sturgeon (n=22) from natal rivers into non-natal rivers (Carr et al. 1996; Craft et al. 2001; Fox et al. 2002; Ross et al. 2001; Wooley and Crateau 1985).

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 and noted significant differences among Gulf sturgeon stocks, which suggests 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).

After spawning, Gulf sturgeon move downstream to areas referred to as summer resting or holding areas. Adults and sub-adults 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 (Chapman and Carr 1995, Carr et al. 1996), 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 estuaries and associated bays begins in September (at water temperatures around 23°C) and continues through November (Foster and Clugston 1997; Huff 1975; Wooley and Crateau 1985). Because the adult and large sub-adult sturgeon have spent at least six months fasting or foraging sparingly on detritus (Mason and Clugston 1993) 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. 2007; Edwards et al. 2003).

Most sub-adult and adult Gulf sturgeon spend the cool winter months (October/November through March/ April) in the bays, estuaries, and the nearshore Gulf of Mexico (Clugston et al. 1995; Fox et al. 2002; Odenkirk 1989). Tagged fish have been located in well-oxygenated shallow water (less than 7 m) areas that support burrowing macro invertebrates (Craft et al. 2001; Fox and Hightower 1998; Fox et al. 2002; Parauka et al. 2001; Rogillio et al. 2007; Ross et al. 2001; Ross et al. 2009). These areas may include shallow shoals 5-7 ft (1.5-2.1 m), deep holes near passes (Craft et al. 2001), unvegetated sand habitats such as sandbars, and intertidal and subtidal energy zones (Abele and Kim 1986; Menzel 1971; Ross et al. 2009). Sub-adult and adult Gulf sturgeon overwintering in Choctawhatchee Bay (Florida) were generally found to occupy the sandy shoreline habitat at depths of 4-6 ft. [2-3 m, (Fox et al. 2002; Parauka et al. 2001)]. 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 (Abele and Kim 1986; AFS 1989; Menzel 1971), (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 are described as opportunistic and indiscriminate benthivores that change their diets and foraging areas during different life stages. Their guts generally contain benthic marine invertebrates including amphiopods, lancelets, polychaetes, gastropods, shrimp, isopods, molluscs, and crustaceans (Carr et al. 1996; Fox et al. 2002; Huff 1975; Mason and Clugston 1993). Generally, Gulf sturgeon prey are burrowing species that feed on detritus and/or suspended particles, and inhabit sandy substrate. In the river, YOY sturgeon eat aquatic invertebrates and detritus (Mason and Clugston 1993; Sulak and Clugston 1999) and juveniles forage throughout the river on aquatic insects (e.g., mayflies and caddis flies), 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 sub-adult Gulf sturgeon are known to lose up to 30% of their total body weight while in fresh water, and subsequently compensate the loss during winter feeding in marine areas (Carr 1983; Clugston et al. 1995; Heise et al. 1999; Morrow et al. 1998; Ross et al. 2000; Sulak and Clugston 1999; Wooley and Crateau 1985).

Status and Population Dynamics

Abundance of Gulf sturgeon is measured at the riverine scale. Currently, seven rivers are known to support reproducing populations of Gulf sturgeon: Pearl, Pascagoula, Escambia, Yellow, Choctawhatchee, Apalachicola, and Suwannee. Gulf sturgeon abundance estimates by river and year for the seven known reproducing populations are presented in Table 7. The number of individuals within each riverine population 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. In the western portion of the range, populations in the Pearl and Pascagoula Rivers, 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 7. 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. For example, 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, Louisiana, that may have affected 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.[18] The untreated waste byproduct created a low oxygen ("hypoxic") environment 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 (LDWF 2011) and anecdotal information suggests many other Gulf sturgeon carcasses were not collected. The smaller fish collected represent YOY and indicate spawning is likely occurring in the Pearl River. The spill occurred during the time when Gulf sturgeon were still occupying the freshwater habitat. Because the materials moved downriver after the spill, the entire Pearl River population of Gulf sturgeon was likely impacted.

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):

[18] 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.

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, dichlorodiphenyldichloroethylene, dichlorodiphenyltrichloroethane, dieldrin, polychlorinated biphenyls, 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 1995a). 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.

Summary of the Status of Gulf Sturgeon
In summary, the Gulf sturgeon population is estimated to number approximately 19,000 individuals. The number of individuals within each riverine population 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. Recovery of depleted populations is an inherently slow process for a late-maturing species such as Gulf 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 the species range by habitat alteration, pollution, and bycatch.

A wide range of threats continue to dictate the status of Gulf sturgeon and their recovery. Modification of habitat through dams, the operation of dams, and dredging particularly impact Gulf sturgeon. The presence of dams reduces the amount of available spawning habitat or entirely impedes access to it, while ongoing operation of these dams affects downstream water quality parameters such as depth, temperature, velocity, and DO. Similarly, dredging projects modify Gulf sturgeon spawning and nursery habitat through direct removal of habitat features or reduced water quality due to nutrient-loading, anoxia, and contaminated sediments. Water quality can be further influenced by inter-basin water transfers and climate change which may exacerbate existing water quality issues. Further, access to habitat and water quality continues to be a problem even with NMFS's authority under the Federal Power Act to prescribe fish passage and existing controls on some pollution sources. The inadequacy of regulatory mechanisms to control habitat alterations is contributing to the status of Gulf sturgeon.

Bycatch is also a current threat to the species that is contributing to its status. Although confirmed reports are rare, it is a common opinion among Gulf sturgeon researchers that bycatch mortality continues. While many of the threats to Gulf sturgeon have been ameliorated or reduced due to the existing regulatory mechanisms, such as the moratorium on directed fisheries, bycatch is not currently being addressed. Therefore, losses of Gulf sturgeon as bycatch likely continue.

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 (Erickson et al. 2011; Stein et al. 2004b). 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 (ASSRT and NMFS 2007; Collins and Smith 1997; Laney et al. 2007; Munro et al. 2007; Stein et al. 2004b) where they are subject to bycatch mortality by commercial fisheries (Armstrong and Hightower 2002; Collins et al. 1996; Spear 2007; Stein et al. 2004a; Trencia et al. 2002), poor water quality in certain estuaries (Collins et al. 2000b; 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: Southeast 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 5; 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.

Southeast shrimp trawl fisheries
As described in Section 1.0 and 2.0, formal consultation has previously been conducted on Southeast shrimp fisheries, most recently in 2012. While present and future effects of Southeast shrimp trawl fisheries is the subject of this consultation, thus not considered part of the environmental baseline, the past effects from NMFS's implementation 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 2002b). TEDs approved for use have had to demonstrate 97% 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% 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% for loggerheads and 97% for leatherbacks.

Interactions between sea turtles and otter trawls in the years leading up to the May 8, 2012 consultation were thought to be declining because of reductions in fishing effort that were unrelated to fisheries management actions, as well as improvements in TED designs. 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% 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. (2002b) estimated CPUEs and 2007 effort data in Nance et al. (2008) were significantly less than predicted in the 2002 opinion (Table 8).

Table 8. 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

On August 16, 2010, reinitiation of consultation on sea turtle effects was triggered by based on elevated strandings in the Northern Gulf of Mexico 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 were being affected by shrimp trawling, under the sea turtle conservation regulations and federal FMPs, to an extent not considered in the 2002 opinion, despite lower fishing effort levels.

On May 8, 2012, NMFS completed the new opinion which analyzed the continued implementation of the sea turtle conservation regulations and the continued authorization of the Southeast U.S. shrimp fisheries in federal waters under the Magnuson-Stevens Act (NMFS). Sea turtle interactions and captures for otter trawls were estimated to be significantly higher than estimated in the 2002 opinion and the 2008 memorandum due to increases in Kemp's ridley and green sea turtle population abundance, incorporation of the TED compliance data and the effects those violations have on expected sea turtle captures rates, and incorporation of interactions in shrimp trawl gear types previously not estimated (i.e., skimmer trawls and try nets). An ITS was provided that used trawl effort and capture rates as surrogates for numerical sea turtle take levels. The opinion required NMFS to minimize the impacts of incidental takes through monitoring of shrimp effort and regulatory compliance levels, conducting TED training and outreach, and continuing to research the effects of shrimp trawling on listed species.

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 2004c). This does not account for post-release mortalities, which historically were likely substantial.

NMFS reinitiated consultation in 2003 on pelagic longline fisheries as a result of exceeded incidental take levels for loggerheads and leatherbacks (NMFS 2004c). The resulting 2004 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.

On March 31, 2014, the NMFS, Office of Sustainable Fisheries, HMS Management Division requested that SERO reinitiate formal Section 7 consultation for the Atlantic pelagic longline (PLL) fishery based on the availability of information revealing effects of the action that may affect listed species in a manner or to an extent not previously considered (see 50 C.F.R. § 402.16 (b)). Specifically, the request is based on information indicating that the net mortality rate and total mortality estimates for leatherback sea turtles specified in the reasonable and prudent alternative were exceeded (although the take level specified in the incidental take statement has not been exceeded), changes in information about leatherback and loggerhead sea turtle populations, and new information about sea turtle mortality associated with PLL gear.

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 a 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 2005c) 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 2009c). 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 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, and an ITS was provided (NMFS 2011).

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 2006b) 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 LCS, small coastal sharks, and pelagic sharks have been managed by NMFS since the 1993 under an 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% 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 that have been 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% 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

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 2008b). To protect declining shark stocks, Amendment 2 sought to greatly reduce the fishing effort in the commercial component of the fishery. These effort reductions are believed to have greatly reduced 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's 2009 research objectives. The shark research fishery permits authorize participation in the shark research fishery and the collection of sandbar and non-sandbar LCS from federal waters in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea for the purposes of scientific data collection subject to 100% 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 was 87.9 mt dw per year through December 31, 2012, and has been 116.6 mt dw/year since January 1, 2013. The selected vessels have access to the non-sandbar LCS, small coastal shark, and pelagic shark quotas. Commercial vessels not participating in the shark research fishery are subject to 4-6% observer coverage and 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.

During 2007-2011, 10 sea turtle (all loggerheads) takes were observed on bottom longline gear in the sandbar shark research fishery and 5 were taken outside the research fishery. The five non-research fishery takes were extrapolated to the entire fishery, providing an estimate of 45.6 sea turtle takes (all loggerheads) for non-sandbar shark research fishery from 2007-2010 (Carlson and Richards 2011). No sea turtle takes were observed in the non-research fishery in 2011 (NMFs unpublished data). Since the research fishery has a 100% observer coverage requirement those observed takes were not extrapolated (Carlson and Richards 2011).

The most recent ESA Section 7 consultation was completed on December 12, 2012, on the continued operation of shark fisheries and Amendments 3 and 4 to the Consolidated HMS FMP (NMFS 2012). Amendment 3 to the Consolidated HMS FMP (74 FR 36892; July 24, 2009) implemented measures to bring smoothhound sharks under federal management and end overfishing of blacknose and shortfin mako sharks. The amendment also implemented measures to rebuild blacknose sharks consistent with the 2007 small coastal shark (SCS) stock assessment, the MSFCA, and other domestic law. Amendment 4 to the Consolidated HMS FMP amended

HMS fishery management regulations related to Atlantic sharks in the U.S. Caribbean to address substantial differences between some segments of the U.S. Caribbean HMS fisheries and the HMS fisheries that occur off the mainland of the United States. The 2012 shark opinion analyzed the potential adverse effects from the smoothhound fishery on sea turtles for the first time. Few smoothhound trips have been observed and no sea turtle captures have been documented in the smoothhound fishery. The opinion concluded the entire proposed action was not likely to jeopardize the continued existence of sea turtles. An ITS was provided.

Coastal Migratory Pelagic Resources (CMPR) Fishery
NMFS completed a Section 7 consultation on the continued authorization of CMPR fishery in the Gulf of Mexico and South Atlantic (NMFS 2007d). 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 2007d). 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.

On November 26, 2012, NMFS requested reinitiation of consultation to evaluate the potential impact of this fishery on the recently listed five distinct population segments of Atlantic sturgeon. That consultation is ongoing.

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 2009c)]. 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 2009c). 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 sea turtles. 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 was likely to adversely affect sea turtles, 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% 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 2003b). 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 USACE.

Military
Normal 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 2004b), the Precision Strike Weapons Tests (NMFS 2005b), the Santa Rosa Island Mission Utilization Plan (NMFS 2005f) and Naval Explosive Ordnance Disposal School (NMFS 2004a). 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 USACE's hopper-dredging operation in 1997 for dredging along the South Atlantic (NMFS 1997b)and in 2003 for operations in the Gulf of Mexico (NMFS 2007e). 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 likely to be 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 2005a)], Gulfport Harbor Navigation Project [to USACE in 2007 (NMFS 2007c)], East Pass dredging, Destin, Florida [to USACE in 2009 (NMFS 2009a)], Mississippi Coastal Improvements Program (federal restoration project) dredging and disposal of sand along West Ship Island barrier island [to USACE in 2010 (NMFS 2010a)], and dredging of City of Mexico beach canal inlet [to USACE in 2012 (NMFS 2012a)]. 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 USACE (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 2010b)], channel dredging for homeporting of carrier group surface ships at U.S. Naval Station Mayport [opinion issued to USN in 2009 (NMFS 2009b)], and Boca Raton Inlet Dredging Project [opinion to USACE, 2008 (NMFS 2008a)], 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.

Since the 1997 SARBO consultation was signed, several reinitiation triggers have been met, such as: (1) modification of the proposed activity, (2) listing of new species, (3) the inclusion of Puerto Rico and the U.S. Virgin Islands which had been excluded from previous opinions, and (4) the current status of Section 10(a)(1)(A) scientific research permits. The USACE and NMFS have been collaborating to revise this consultation in a way that addresses the actions modified scope, participating co-acting agencies (BOEM), and new environmental realities that have occurred since 1997, and expect to issue a new opinion in late 2014.

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 USACE-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, USACE) 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 2002c), November 29, 2002 (NMFS 2002a), August 30, 2003 [Lease Sales 189 and 197, (NMFS 2003a)], and June 29, 2007 [2007-2012 Five-Year Lease Plan, NMFS 2007b (NMFS 2007b)] 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 2006a). 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’s 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's projections. However, NMFS has not yet issued a opinion concluding the reinitiated consultation.

Impact of Deep Water Horizon Oil Spill on Status of Sea Turtles

On April 20, 2010, while working on an exploratory well approximately 50 miles offshore Louisiana, the semi-submersible drilling rig Deepwater Horizon (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. Millions of barrels of oil were released into the Gulf. 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 event and associated response activities (e.g., skimming, burning, and application of dispersants) have resulted in adverse effects on listed sea turtles.

At this time, the total effects of the oil spill on species found throughout the Gulf of Mexico, including ESA-listed 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, loss of foraging resources which could lead to compromised growth and/or reproductive potential, harm to foraging, resting and/or nesting habitats, and disruption of nesting turtles and nests. There is currently an ongoing investigation and analyses 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.

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 9). 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 sublethal 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% of all recovered turtles (alive and dead), and 79% of all dead turtles recovered. Green turtles accounted for 17.5% of all recoveries (alive and dead), and 4.8% of the dead turtles recovered. Loggerheads comprised 7.7% of total recoveries (alive and dead) and 11% 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 9. 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 have been attributed to bycatch mortality in the shrimp fishery. As a result, on August 16, 2010, NMFS reinitiated Section 7 consultation on Southeast 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 sub-adult 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 10). 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 10. 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 sub-adults 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.

Available information indicates hawksbill and leatherback sea turtles were least affected, at least directly, by the oil spill. 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; 2000a). 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's 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 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 included 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 were 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 June 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 (76 FR 37050). Scoping meetings were held from July

12-18, 2011, in Louisiana, Mississippi, Alabama, and North Carolina, but a DEIS was never published. Ultimately, NMFS decided more research and development on TEDs for these fisheries was needed prior to any regulatory proposals and is focusing on those efforts.

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% 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 approximate 9% representation from this subpopulation in the overall U.S. sea turtle nesting populations. Specifically, the genetic composition of sea turtles in this area is 25-54% from the northern subpopulation, 46-64% from the South Florida subpopulation, and 3-16% from the Yucatan subpopulation. The cumulative removal of these 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's 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 points for material at or near the surface of the water.

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, 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 Southeast 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
Five-year status reviews were completed in 2007 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. 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 completed a revised recovery plan for the loggerhead sea turtle on December 8, 2008 (NMFS and USFWS 2008a) and published a final rule on September 22, 2011, listing loggerhead sea turtles as separate DPSs. A revised recovery plan for the Kemp's ridley sea turtle was completed on September 22, 2011. On October 10, 2012, NMFS announced initiation of 5-year reviews of Kemp's ridley (*Lepidochelys kempii*), olive ridley (*Lepidochelys olivacea*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*) sea turtles) and requested submission of any pertinent information on those sea turtles that has become since their last status review in 2007.

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 actions in the action area that adversely affect smalltooth sawfish stem from NMFS-authorized fisheries, COE-permitted piers, and ESA permitted activities.

4.3.1.1 Fisheries

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 shark fisheries, coastal migratory pelagic resources, and the spiny lobster fishery in the South Atlantic and Gulf of Mexico, the South Atlantic snapper-grouper fishery, and the Gulf of Mexico reef fish fishery. A summary of each of consultation is provided below; more detailed information can be found in the respective most recent opinions. South Atlantic and Gulf of Mexico shrimp fisheries have also undergone previous section 7 consultations, but because these fisheries are being analyzed as this opinion's subject proposed action, only their past effects (see Section 1 [Consultation History]) are considered part of this environmental baseline.

Atlantic Shark Fisheries

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 gillnet fisheries, as well as recreational shark fisheries. The commercial shark bottom longline and gillnet fisheries are both known to adversely affect smalltooth sawfish.

NMFS has formally consulted three times on the effects of HMS shark fisheries on smalltooth sawfish (i.e., NMFS 2003c, NMFS 2008c, NMFS 2012). NMFS also began authorizing a federal smoothhound fishery that will be managed as part of the HMS shark fisheries. NMFS (2012) considered the potential adverse effects from the smoothhound fishery on smalltooth sawfish for the first time. Both bottom longline and gillnet are known to adversely affect smalltooth sawfish. From 2007-2011, the sandbar shark research fishery had 100 percent observer coverage and with 4-6 percent observer coverage in the remaining shark fisheries. During that period, smalltooth sawfish were only observed taken in bottom longline gear. Sixteen smalltooth sawfish captures were observed in the sandbar shark research fishery and six were taken outside the research fishery (Carlson and Richards 2011, NMFS unpublished data); one takes in the shark bottom longline fishery resulted in mortality. The six non-research fishery captures were extrapolated to the entire fishery, providing an estimate of 17.3 total smalltooth sawfish captures for non-sandbar shark research fishery. Since the research fishery has a 100 percent observer coverage requirement those observed captures were not extrapolated (Carlson and Richards 2011). No smalltooth sawfish have been observed captured in the smoothhound fishery.

The most recent ESA Section 7 consultation was completed on December 12, 2012, on the continued operation of HMS shark fisheries and Amendments 3 and 4 to the Consolidated HMS FMP (NMFS 2012). The consultation concluded the proposed action was not likely to jeopardize the continued existence of the smalltooth sawfish, and an ITS was provided.

Coastal Migratory Pelagic Resources Fishery

NMFS recently completed a Section 7 consultation on the continued authorization of the coastal migratory pelagic fishery in the Gulf of Mexico and South Atlantic (NMFS 2007a). In the Gulf of Mexico, hook-and-line, gillnet, and cast net gears are used. Gillnets are the primary gear type used by commercial fishermen in the South Atlantic, while the recreational sector uses hook-and-line gear. The biological opinion concluded that smalltooth sawfish may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize its continued existence and an ITS was provided.

On November 26, 2012, NMFS requested reinitiation of consultation to evaluate the potential impact of this fishery on the recently listed five distinct population segments of Atlantic sturgeon. That consultation is ongoing.

Gulf of Mexico Reef Fish Fishery

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 have 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. The most recent biological opinion was issued on September 30, 2011. An ITS was provided authorizing non-lethal takes in the commercial and recreational hook-and-line components of the fishery.

South Atlantic Snapper-Grouper Fishery

A Section 7 consultation on the fishery was completed by NMFS on June 7, 2006 (NMFS 2006c). The fishery uses: spear and powerhead, black sea bass pot, 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). The consultation concluded the hook-and-line component of the fishery was likely to adversely affect smalltooth sawfish, but was not likely to jeopardize its continued existence. An ITS was issued for takes in the hook-and-line component of the fishery.

Spiny Lobster Fishery

NMFS completed a Section 7 consultation on the Gulf and South Atlantic Spiny Lobster FMP on August 27, 2009 (NMFS 2009d). The commercial component of the fishery consists of diving, bully net and trapping sectors; recreational fishers are authorized to use bully net, and hand-harvest gears. Of the gears used, traps are expected to result in adverse effects on smalltooth sawfish. 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.

Stone Crab Fishery

NMFS completed a Section 7 consultation on the Gulf of Mexico Stone Crab FMP on September 28, 2009 (NMFS 2009c). 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 sea turtles. 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 was likely to adversely affect 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. Since the State of Florida has essentially been the lead management agency for the state and federal fishery for some time, little change in how the fishery operates or amount of the effort occurring in the fishery is expected because of the repeal of the federal FMP. Therefore, the anticipated adverse effects described in the biological opinion completed before the repeal of the federal FMP are expected to continue to occur to those ESA-listed species.

4.3.1.2 Construction and Operation of COE-Permitted Fishing Piers

NMFS has consulted with the COE on the construction and operation of a number of fishing piers that may have adverse effects to smalltooth sawfish because of the potential impacts of recreational fishing from these piers on smalltooth sawfish, but effects have been minor to date (e.g. one or two non-lethal interactions a year).

4.3.1.3 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. To date, NMFS has three active 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 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. 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.[19] 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.

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 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.

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

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. Atlantic sturgeon bycatch mainly occurs in gillnets, with the greatest number of captures and highest mortality rates occurring in sink gillnets, but captures are documented in trawls too. 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.

Fisheries in the South Atlantic that NMFS authorizes the use of gillnet for under FMPs include coastal migratory pelagic resources fisheries and Atlantic HMS directed shark fisheries. A brief summary of each of these fisheries is provided below, but more detailed information can be found in the respective opinions. The South Atlantic federal shrimp fishery is the only fishery in the South Atlantic that NMFS authorizes the use of otter trawls. This fishery is being analyzed in this document as part of the proposed action so only its past effects are considered as part of this environmental baseline.

Coastal Migratory Pelagic Resources Fisheries
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 2007d).

The last completed consultation on the continued authorization of the coastal migratory pelagic resources fishery in the Gulf of Mexico and South Atlantic was completed prior to NMFS listing Atlantic sturgeon under the ESA(NMFS 2007d). On November 26, 2012, NMFS requested reinitiation of that consultation to evaluate the potential impact of this fishery on the recently listed five distinct population segments of Atlantic sturgeon. That consultation is ongoing, but bycatch levels are likely to be very low since gillnets are no longer the predominant gear used on the Atlantic Coast.

Atlantic HMS Directed Shark Fisheries
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. A Section 7 consultation was completed on December 12, 2012, on the continued operation of shark fisheries and Amendments 3 and 4 to the Consolidated HMS FMP (NMFS 2012). This was the first consultation on these fisheries that included analysis of Atlantic sturgeon. Amendment 3 to the Consolidated HMS FMP (74 FR 36892; July 24, 2009) implemented measures to bring smoothhound sharks under federal management and end overfishing of blacknose and shortfin mako sharks. The amendment also implemented measures to rebuild blacknose sharks consistent with the 2007 small coastal shark (SCS) stock assessment, the MSFCA, and other domestic law. Amendment 4 to the Consolidated HMS FMP amended HMS fishery management regulations related to Atlantic sharks in the U.S. Caribbean to address substantial differences between some segments of the U.S. Caribbean HMS fisheries and the HMS fisheries that occur off the mainland of the United States.

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 1997a), 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 1997a; NMFS 2004b; NMFS 2005b).

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 state waters. 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% 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 captures 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; Drevnick and Sandheinrich 2003; Hammerschmidt et al. 2002; Longwell et al. 1992), reduced egg viability (Billsson et al. 1998; Giesy et al. 1986; Mac and Edsall 1991; Matta et al. 1997; Von Westernhagen et al. 1981), 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; Moore and Waring 2001; Scholz et al. 2000; 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 sublethal 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 sublethal 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. 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.

4.4.5 Summary and Synthesis of Environmental Baseline for Atlantic Sturgeon

In summary, relatively few factors adversely affect Atlantic sturgeon in the South Atlantic. However, these factors are ongoing and are expected to occur contemporaneously with the proposed action. Atlantic sturgeon will be taken annually through fishing and 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 Atlantic sturgeon critical habitat, but the extent of that impact is not yet well understood. Actions to conserve and recover Atlantic sturgeon are expected to continue.

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. A December 15, 2009, observed shrimp trawl capture was the first and only observed bycatch record in federal waters and was released alive. Prior to the May 2012 shrimp opinion, 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 2006a), July 11, 2002 (NMFS 2002c), November 29, 2002 (NMFS 2002a), August 30, 2003 [Lease Sales 189 and 197, (NMFS 2003a)], and June 29, 2007 [2007-2012 Five-Year Lease Plan, (NMFS 2007b)] 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 DWH well. 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 cleanup 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 2 Gulf sturgeon near Mobile Bay, Alabama; 5 near Gulf Shores, Alabama; 1 near Destin, Florida; and 8 near Panama City Beach, Florida. 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 USACE 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 3-inch square mesh, up to 3,000 ft in length) and the year-round 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 (Agusa et al. 2004; Barannikova 1995; Barannikova et al. 1995; Bickham et al. 1998; Billard and Lecointre 2001; Kajiwara et al. 2003; Karpinsky 1992; Khodorevskaya et al. 1997; Khodorevskaya and Krasikov 1999). 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 (Barannikova et al. 1995; Shagaeva et al. 1993; Verina and Peseridi 1979). 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 (Altuf'yev et al. 1992; Dovel et al. 1992; Georgi 1993; Graham 1981; Heath 1995; Khodorevskaya et al. 1997; Kruse and Scarnecchia 2002; Romanov and Sheveleva 1993)).

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 (Culp et al. 2000; Folmar et al. 1996; Wallin et al. 2002; Wildhaber et al. 2000). 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 (Aguayo et al. 2004; Björkblom et al. 2009; Iwanowicz et al. 2009; Nakada et al. 2004; Pait and Nelson 2002). 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 normoxic 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 (Crocker and Cech 1997; Niklitschek 2001; Nonnotte et al. 1993; Secor and Gunderson 1998).

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, Florida, 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 USACE 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 3 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 and fish. 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. TEDs 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 1995a) 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 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

The scope of the effect analysis for this opinion is (1) the effect that NMFS's 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 conservation regulations may affect other species via their 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 is not responsible for the take of these other listed species in state-managed fisheries and does not authorize that take via the ITS. Finally, 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 reviewing 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 and are limited to 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 strikes, shrimp trawl vessel strikes with sea turtles are extremely unlikely given the slow speed (2-3 knots) at which shrimp trawls are towed.

There are no indirect effects associated with the proposed action that are likely to adversely affect listed species. We considered whether or not there would be an increased likelihood of sea turtles being struck by vessels as a potential indirect effect (i.e., effects caused by the proposed action that are later in time, but reasonably certain to occur) of shrimp trawling, given that a sea turtle recovering from a forced submergence encounter would most likely remain resting on the surface longer than it usually would. However, highly efficient TEDs, like the 71-inch TED and double-cover TED are now required in otter trawls, with sea turtle TED escape times of around

30 seconds. It is likely that increases in TED efficiency (i.e., the amount of time it takes most sea turtles to escape) have reduced the extent of respiratory and metabolic stresses that sea turtles experience from otter trawl forced submergence encounters and, therefore, also reduced the extent of any physiological recovery time these sea turtles would need. Also, any sea turtles resting at the surface would be most likely to encounter another shrimp trawl and as noted above, shrimp trawl vessel strikes with sea turtles are extremely unlikely given the slow speed (2-3 knots) at which shrimp trawls are towed. Based on this information, we concluded that the potential indirect effect of increased vessel strikes attributed to the proposed action is not reasonably certain to occur and is discountable. 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 on 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 that otter trawls (5.1.3), skimmer trawls (5.1.4,) and TED-exempted gears and activities (5.1.5) adversely affect loggerhead, Kemp's ridley, green, and leatherback sea turtles, 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 in quantifying sea turtle captures, we adjust our sea turtle capture estimates based on anticipated long-term compliance rates with existing sea turtle conservation requirements and associated sea turtle capture rates. After separately analyzing each component of the proposed action, in Section 5.1.6 we summarize the overall results and discuss sources of error associated with our bycatch analyses. Hawksbill sea turtles are analyzed separately in Section 5.1.7. Finally, we synthesize the effects on all sea turtles in Section 5.1.8.

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 cod end of the net and are caught. The vast majority of sea turtles that encounter 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 trawl gear may be found dead, comatose, or alive, depending on the extent of forced submergence effects. Based on fishery observation, naked (i.e., no TED) net, and TED studies, aside from forced submergence-related effects, physical contact with the trawl gear itself (e.g., netting, footrope) does not cause sea turtle injuries. The following discussion summarizes in greater detail available information on how individual sea turtles are likely to respond to forced submergence via 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 either CORT or androgen responsiveness to a capture/restraint stressor in order 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 Díez 1998). Similarly, juvenile green sea 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 subtropical and temperate areas do exhibit site fidelity, as sea turtles are often recaptured at specific locations within a given year, as well as between years, after having undergone seasonal migrations (Avens and Lohmann 2003; Byles 1988). During a mark-recapture study spanning four years, an average of 21% 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% and 21% 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% 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 sea 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 subtropical and temperate areas will also return to their capture areas (Byles 1988; Lutcavage and Musick 1985). Over the course of a four-year study, 17% 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%. For the Atlantic, the mortality estimate was 21%, 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% for tow times in excess of 200 minutes…Death rates never reach 100% 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. (2002b) 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 three depth strata (inshore, nearshore, and offshore) and five sub-regionsub-regions (two sub-regions in the Gulf of Mexico and three sub-regionsub-regions in the Atlantic). Epperly et al. (2002b) 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% as a sea turtle caught within the last hour of a long tow would likely survive.

The Epperly et al. (2002b) re-analysis of the Henwood and Stuntz data produced mortality estimates by strata based on updated fishery information. The results are presented in Table 11. 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 to 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 sub-regionsub-region of the Atlantic, and the mortality rates are the same as for the Central sub-regionsub-region of the Atlantic. Epperly et al. (2002) provides additional information on the data sources, methods, and sources of error.

Table 11. Proportion of Animals Retained in Trawls that Likely Drown, By Area/Sub-region, Depth, and Season (i.e., Table 26 in Epperly et al. 2002).

Area/Sub-region	Depth Stratum	Season	
		Summer (March through 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% by (Henwood and Stuntz 1987) and (NRC 1990)], intermediate tow times resulted in a rapid escalation in mortality (10-200 minutes in summer and 10-150 minutes in winter), and eventually reached a plateau of high mortality."

The tow time regulatory limits were based on the belief that 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). Epperly et al. (2002b) and Sasso and Epperly (2006) (both of which used the same data set) found the stress of being captured in an otter 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. Epperly et al. (2002b) and Sasso and Epperly (2006) show curves which predict the likelihood of encountering a dead turtle at a given tow time by season based on actual observed mortalities in shrimp otter trawls. The curves do not predict the probability of an individual turtle dying at a given tow time. We believe Sasso and Epperly (2006), which indicates that mortality rates associated with forced submergence are higher in the winter, represent the best scientific information available because they are based on actual shrimp fishery data rather than general sea turtle physiology research.

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 smaller 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 11 above represent the best available scientific information on which to base sea turtle mortality in trawls not fitted with TEDs. Indirect effects of species composition, age, and size on survival from differences in TED exclusion are discussed below.

Effect of Legal TED Use on Sea Turtle Interactions, Captures, and Mortality
With its position just before the cod end in trawl nets, the use of TEDs in otter trawls 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% exclusion efficiency rate (NMFS 1981). Based on 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% turtle exclusion efficiency rate depending on turtle size (J. Gearhart memorandum to S. Epperly, NMFS, March 29, 2011); the lower efficiency rate was documented for smaller sea turtles used in NMFS's small sea turtle testing protocol between 2001-2010, which relied on 2- to 3-year-old juvenile turtles (26.5 to 39 cm SCL), while the higher efficiency rate was documented in NMFS's wild turtle testing protocol between 2002-2007, which typically witnessed 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% exclusion efficiency rate as representative of the exclusion efficiency rate of compliant TEDs in the fleet, as we did in NMFS (2002) and (NMFS 2012c), is still appropriate.

The currently approved TEDs are believed to effectively exclude the vast majority of size classes and species of sea turtles encountered by shrimp otter trawls. In trawls equipped with properly-functioning approved TEDs, sea turtles are able to escape quickly through it and avoid forced submergence. Generally, sea turtles will orient/swim forward toward the trawl net opening when overtaken and continue swimming outward until overtaken and stopped by the TED grid. After briefly exploring the area around the TED (usually searching upwards), sea turtles will find the escape opening and turn to exit the opening head-first. The control TED used during TED testing trials from 1997 to 2000 (a top-opening, bent-bar TED, with a 10 inch by 32 inch escape opening [i.e., the Gulf legal opening size during that time period) had mean escape times for the captive-reared turtles (i.e., the small-sized sea turtles referenced above) ranging from 83 to 118 seconds. By comparison, the wild loggerheads encountering trawls equipped with the 71-inch opening TED or the double-cover TED (the TEDs now required in offshore waters) had mean escape times of 31 seconds. Most sea turtles actually had a much quicker escape (the 31-second average is biased high by a couple of slower escapes; the median escape time was 19 seconds). Wild loggerheads encountering the 44-inch opening TED (the TED now required for inshore use) 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 results in 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. 2002b), 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 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. 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 cod end enters the water until it is removed from the water. 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. Thus, the summer and the winter regulatory limits are expected to result in near zero sea turtle deaths because of expected bottom times under 60 minutes.

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 if boarded by law enforcement authorities.

Effects of TED Construction and/or Installation on TED Efficiency

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 relatively small variances above the 55-degree maximum angle will prevent many small sea turtles from escaping the net (e.g. a 58-degree angle is expected to result in the capture of 70% of the small juvenile sea turtles that try to escape via the TED). In contrast, escape openings of insufficient size 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 in impeding a turtle's exit. While these issues do not represent as significant a threat as steep TED angles and insufficient escape opening size, they still can hinder turtle escapement from a trawl net. Non-compliant TEDs sometimes have multiple problems, which may act in concert to further worsen the chances of a sea turtle escaping.

Effect of Multiple Interactions

Sea turtles may interact with trawls more than once, thus the number of individual sea turtles that shrimp trawls interact with is expected to be less than estimates of sea turtle interactions. The overall effect of multiple interactions depends on the number of individual sea turtles experiencing multiple interactions and the extent of adverse effects on those individual sea turtles.

Epperly et al. (2002b) addressed the potential for multiple interactions with 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 those areas. Epperly et al. (2002b) noted that, based on recapture studies, it appears that at least 20% of sea turtles involved in non-lethal interactions subsequently will be recaptured[20]. Epperly et al (2002b) also noted that the estimate of 20% is likely biased quite low because the studies it was based on generally worked with just a single fishing operation and did not receive recapture information from all of the fishing operations in the vicinity. In contrast, shrimp fishing is often congregated in relatively small areas to target high densities of shrimp.

How individual sea turtles are affected by multiple captures depends on the time interval between captures. 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 the related potential indirect effect from recovering at the surface such as increases in sea turtle vessel strikes). 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, CO_2, and lactate, but as the number of submergences increased, the acid-base imbalances were substantially reduced relative to the imbalance caused by the first submergence. Increasing the time interval between successive submergences resulted in greater recovery of blood homeostasis. The authors conclude that 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 our 2002 shrimp opinion we discussed how repeated captures in a short time period could contribute to sea turtle mortality, but concluded that there were few 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).

Newer information on the potential for multiple captures is generally consistent with Epperly et al. (2002), with the exception that there is some indication recapture probability may differ among locations (Memorandum from Ponwith, Ph.D, to Crabtree, Ph.D., dated December 16, 2011). In 2011, SEFSC worked with SCDNR to design a study to re-sample 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 sea turtles' exposure to capture by multiple vessels in the shrimp fleet. The

[20] Epperly et al. uses the term recaptured to describe any sea turtle that is released via a TED and subsequently interacts with a trawl again at a later time.

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.

With more sea turtles likely in fishing areas now because of sea turtle population increases, the total number of sea turtles available to be caught multiple times would be higher. However, there is no available information to indicate that the actual rate of recapture would be greater at higher sea turtle densities. Increased abundance is not expected to limit the home ranges of individual sea turtles. Whether there still are correlations between shrimp effort and sea turtle strandings now over ten years later, or to what spatial and temporal extent they exist and are attributed to mortality associated with sea turtles being captured multiple times, is presently unknown. With highly efficient TEDs, like the 71-inch TED and double-cover TED now required in otter trawls, and TED escape times of around 30 seconds, it is particularly difficult to assign significant physiological risk to sea turtles that repeatedly interact with otter trawls. It is likely that increases in TED efficiency (i.e., the amount of time it takes most sea turtles to escape) have decreased the extent of respiratory and metabolic stresses associated with initial forced submergence that sea turtles experience and also reduced the extent of any physiological recovery time these sea turtles need. Also, the number of times any individual sea turtle is caught is believed to be effort dependent (i.e., the more trawls fishing an area, the more times it is likely that an individual sea turtle will be captured). Thus, with the declines in effort in all shrimp fisheries discussed in Section 2, which have occurred since 2001, the densities of trawlers on shrimp grounds have likely declined by a similar amount to effort declines. For all of these reasons, we believe the risk of, and associated with, repeated captures is probably much lower now than in 2001. A significant unknown is a sea 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 Loggerhead, Kemp's ridley, Green, and Leatherback Sea Turtles from Otter Trawls

In this section we address the question of how many sea turtles will be adversely affected by otter trawls by the proposed action. We do this by (1) reviewing the effects analysis of the 2012 opinion, (2) summarizing relevant new information since its completion, and (3) considering how that new information may change the effects of the proposed action that we anticipated from otter trawls on loggerhead, Kemp's ridley, green, and leatherback sea turtles.

5.1.3.1 Overview of 2012 Otter Trawl Effects Analysis

In Sections 5.1.3.1-5.1.3.3 of the 2012 opinion, we analyzed the extent of the proposed action's effects on sea turtles in terms of how many sea turtles are adversely affected by otter trawls. We did that by reviewing the bycatch estimation methods used in NMFS (2002b), summarizing relevant new information since 2002, and describing in detail the methodology we used to try and update the 2002 otter trawl bycatch estimates, along with the results.

In NMFS (2002b), for loggerhead and leatherback sea turtles, we adopted the estimation methods and results of Epperly et al. (2002b) which used CPUEs recalculated from Gulf and South Atlantic Fisheries Foundation data for 1997-1998, adjusted for aerial survey sighting results and 2001 shrimp effort data. We also used the estimation methods of Epperly et al. for Kemp's ridley and green sea turtles, except we recalculated the 1997-1998 Foundation CPUEs to exclude the aerial survey adjustment because the estimates produced using the aerial survey adjustment did not seem credible (see NMFS (2002b) for more detail).

New information that we reviewed in the 2012 opinion for its potential use in estimating otter trawl bycatch included decreases in shrimp otter trawl effort since 2001, substantial increases in Kemp's ridley and green sea turtle abundance since 1997 and 1998, elevated sea turtle strandings in the northern Gulf of Mexico in 2010 and 2011, implementation of a NMFS mandatory shrimp trawl observer program, and sea turtle conservation compliance data and associated catch rate expectations. After considering that information and its potential bycatch estimation application, we attempted to update our 2002 shrimp otter trawl sea turtle bycatch estimates based on (1) declines in the amount of shrimp trawl fishing effort in the Southeast since 2001, (2) increases in the population sizes of Kemp's ridley and green sea turtles which were hypothesized to have increased CPUEs since 1997/1998, and (3) recent information on shrimp industry compliance with TED regulations and the effect that the different TED violations have on trawl capture rates (see NMFS (2012) for more detail).

The resulting 2012 opinion otter trawl bycatch estimates were much higher than those estimated in NMFS (2002b) and in 2011 by the SEFSC,[21] even though shrimp fishing effort had substantially declined since 2001. We attributed that to our incorporation of population growth estimates for Kemp's ridley and green sea turtles and our incorporation of recent TED

[21] January 5, 2011, Memorandum from Bonnie Ponwith, Ph.D. to Roy E Crabtree, Ph.D. re: Data Analysis Request: Update of Turtle Bycatch in the Gulf of Mexico and Southeastern Atlantic Shrimp Fisheries

compliance data and its effect on otter trawl sea turtle capture rates. The population growth rates of both species were indicated by increases in the number of nests, and it was assumed that the change in nest numbers reflected a proportional change in the population size and CPUE. Our incorporation of recent TED compliance data resulted in TEDs being much less effective than previously assumed (i.e., 88% instead of 97% effective). Ultimately, we concluded that there was too much unresolved uncertainty in our sea turtle shrimp trawl bycatch estimates to rely on them extensively in analyzing impacts. The old CPUEs on which our revised CPUEs were based were fraught with many sources of error, even when first produced (Epperly et al. 2002). Also, in order to update the old otter trawl CPUEs and account for population changes in these species, we had to assume that CPUE and population growth rate are linearly related. While it would have been inappropriate to use catch rate and aerial survey data that have not been updated in a decade for Kemp's ridley and green sea turtles because of their known population changes over the last decade, the linearly related assumption was of questionable validity, and small changes in this relationship could have large impacts on the catch and mortality estimates. Finally, while our capture rate analysis based on boarding data was certainly reasonable, it too was based on little empirical data and conservative assumptions, thus was also highly uncertain.

In trying to ground-truth our results, we compared annual Kemp's ridley sea turtle otter trawl interactions and mortalities to Kemp's ridley population estimates. Although there is considerable uncertainty in both population size and trawl mortality estimates too, estimates presented appeared to be unreasonable and too high given that our estimated interactions and mortalities exceeded annual population size and total mortality estimates. Consequently, our sea turtle jeopardy analyses were largely qualitative; we primarily used our knowledge of sea turtle population trends from nesting and other information and related that information to the magnitude of the effects of southeastern shrimp fisheries based on fishing effort and compliance rates. The ITS of the 2012 opinion then laid out a procedure for determining in the future if the impacts of the proposed action on sea turtles exceeded those anticipated and analyzed in the 2012 opinion by monitoring effort and compliance. These two parameters, effort and compliance, were chosen for three main reasons. First, effort is directly related to the number of sea turtles that interact with shrimp trawls. Second, compliance is directly related to the number of sea turtles captured and how many of those sea turtles are subsequently killed. Third, data on these parameters continue to be collected and, while no doubt imperfect, are believed to be more reliable and measureable than our sea turtle otter trawl CPUEs. Future total effort levels in southeastern shrimp fisheries were predicted to remain at or below the most recent levels available at that time so 2009 effort levels[22] were established as our effort baseline. Similarly, future compliance levels were expected to result in TEDs being 88% effective (i.e., keep sea turtle catch rates of shrimp trawls required to use TEDs at or below 12 percent of all sea turtle interactions), thus that level was set as our otter trawl compliance baseline.

[22] Defined in the May 2012 opinion as 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 in 2009] 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 2010]

5.1.3.2 Summary of New Otter Trawl Data for Bycatch Analysis Since May 2012

New information since completion of the 2012 opinion that is relevant to our otter trawl sea turtle bycatch analysis is limited to effort and TED compliance data. In complying with the terms and conditions of the 2012 opinion while this new consultation has been ongoing, we accumulated additional effort and TED compliance data.

The change in the proposed action (i.e., withdrawal of the proposal to require TEDs in skimmer, pusher-head, and wing net trawls) that prompted us to reinitiate consultation on Southeastern shrimp fisheries was specific to skimmer trawls and 2012 skimmer trawl observer data indicating that at least some skimmer trawls interact with very small, juvenile Kemp's ridley sea turtles (e.g., 1 year old, 19.4-48.3 cm CCL) which could potentially pass between the required maximum 4-inch bar spacing of a TED. We considered whether potential problems with the effectiveness of TEDs in skimmer trawls at excluding such very small sea turtles might also apply to otter trawls because there is some overlap in areas fished between skimmer and otter trawls. However, otter trawls typically operate in deeper offshore waters where very small Kemp's ridley sea turtles are not expected to be encountered; Kemp's ridleys, particularly very small Kemp's ridley sea turtles use very shallow nearshore waters where otter trawls uncommonly work. Thus, we believe that very few very small turtles likely pass through the bars of otter trawls as supported by their general absence in observer data.

We also do not know of any other new data available that could be or should be used to revise the methodology that we used in the 2012 opinion to try and update our sea turtle otter trawl CPUEs. Available data sources reviewed in Section 5.1.3.2 of the May 2012 opinion, but not incorporated into our methodology included elevated sea turtle stranding in 2010 and 2011, and implementation of mandatory NMFS shrimp observer coverage in 2007. The mandatory observer program for federally-permitted shrimp trawls described in the 2012 opinion is ongoing, but all of the same problems with using that data for sea turtle bycatch estimation as discussed in the 2012 opinion remain. There are still insufficient data to infer unobserved interactions and captures; thus, the data are still inappropriate for estimating total interactions, captures, and mortalities. That is, any bycatch estimates calculated with only observed interactions, without accounting for the sea turtle interactions that are not observed by observers on deck because the sea turtles escape through a TED, would underestimate actual bycatch and we are unable to quantify to what extent. Also, while the STSSN again documented large numbers of stranded sea turtles in the north-central Gulf of Mexico during last spring and this spring, as it had in 2010 and 2011, the cause or causes of these seasonal strandings remain unclear. Thus, these strandings are considered as part of the baseline and not as an effect of the proposed action.

Without new data to revise the methodology that we used in the 2012 opinion to try and update our sea turtle otter trawl CPUEs, any new sea turtle capture and mortality estimates generated by incorporating updated effort and compliance data, would be subject to the same assumptions and sources of error as those we presented in the May 2012 opinion and ultimately found too uncertain to accurately predict a specific number of each sea turtle species. Therefore, the analysis that follows focuses on our surrogates for sea turtle interactions and captures, that is, effort (i.e., days fished in the Gulf of Mexico and number of trips in the South Atlantic), TED effectiveness (i.e., sea turtle capture rates), and the relative impact of any documented changes to those parameters on the magnitude of effects of the proposed action.

New Otter Trawl Effort Data Relative to the 2009 Effort Baseline Established by NMFS (2012b)

Revised shrimp otter trawl effort data for the South Atlantic in 2009 and new shrimp otter trawl effort data for the Gulf of Mexico and South Atlantic in 2010-2012 are now available. For comparison purposes, 2009-2012 annual estimates are all presented in Table 12; along with the differences in effort of each new data year relative to 2009 effort. In Tables 13 and 14, 2009-2012 effort estimates are presented stratified by geographic sub-region[23], depth stratum, and season according to Epperly et al. (2002b), as well as pooled; difference in 2010-2012 effort relative to 2009 are also presented for each stratum and pooled.

Table 12. 2009 (Revised)-2012 Annual Shrimp Otter Trawl Effort By Region.

Year	Gulf of Mexico No. of Days Fished[24]	South Atlantic No. of Trips[25]
2009	108,501	12502
2010	84,729	14017
2011	96,135	11634
2012	94,100	14265
Δ (2009, 2010)	-23,772	+1,515
Δ (2009, 2011)	-12,366	-868
Δ (2009, 2012)	-14,401	+1,763
Δ (2009, 2010-2012 average)	-16,846	+803

[23] 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).

[24] The estimates for 2009 are from an attachment to a January 5, 2011, Memorandum from Dr. Bonnie Ponwith to Dr. Roy E Crabtree. The estimates for 2010-2012 data are from James Nance, SEFSC, pers. comm. with Jennifer Lee, SERO, via emails on March 5, April 8, and November 1, 2013, and March 21, 2014.

[25]The estimates for 2009-2012 are from David Gloeckner, SEFSC, pers. comm. with Jennifer Lee via email on November 15, 2013.

Table 13. Estimated 2009-2012 Shrimp Otter Trawl Effort (24-hour days fished) by Season, Depth Zone, and Gulf Sub-Region.

		Season: Summer (Mar-Nov) Depth Stratum			Season: Winter (Dec-Feb) Depth Stratum			Summer/ Winter Combined
Region	Year	Inshore*	Nearshore (0-10 fm)	Offshore (>10 fm)	Inshore *	Nearshore (0-10 fm)	Offshore (>10 fm)	All Depth Zones Combined
Western Gulf-Zones 13-21	2009	16,994	28,068	22,098	2,857	4,444	4,371	78,832
	2010	10,611	21,524	20,125	2,513	3,857	5,766	64,396
	2011	13,302	19,768	26,477	3,315	3,628	5,345	71,835
	2012	16,285	28,211	21,310	2,483	4,634	4,238	77,161
	Δ (2009, 2010)	-6,383	-6,544	-1,973	-344	-587	1,395	-14,436
	Δ (2009, 2011)	-3,692	-8,300	4,379	458	-816	974	-6,997
	Δ (2009, 2012)	-709	143	-788	-374	190	-133	-1,671
	Ave Δ (2009-2012)	-3,595	-4,900	539	-87	-404	745	-7,701
Eastern Gulf-Zones 1-12	2009	10,199	5,821	7,681	1,945	1,402	2,623	29,671
	2010	8,564	1,915	4,597	2,521	869	1,867	20,333
	2011	9,149	2,906	6,355	3,590	606	1,694	24,300
	2012	4,352	3,797	6,266	474	380	1,670	16,939
	Δ (2009, 2010)	-1,635	-3,906	-3,084	576	-533	-756	-9,338
	Δ (2009, 2011)	-1,050	-2,915	-1,326	1,645	-796	-929	-5,371
	Δ (2009, 2012)	-5,847	-2,024	-1,415	-1,471	-1,022	-953	-12,732
	Ave Δ (2009-2012)	-2,844	-2,948	-1,942	250	-784	-879	-9,147
Western and Eastern Gulf Combined-Zones 1-21	2009	27,193	33,889	29,779	4,802	5,846	6,994	108,503
	2010	19,175	23,439	24,722	5,034	4,726	7,633	84,729
	2011	22,451	22,674	32,832	6,905	4,234	7,039	96,135
	2012	20,637	32,008	27,576	2,957	5,014	5,908	94,100
	Δ (2009, 2010)	-8,018	-10,450	-5,057	232	-1,120	639	-23,774
	Δ (2009, 2011)	-4,742	-11,215	3,053	2,103	-1,612	45	-12,368
	Δ (2009, 2012)	-6,556	-1,881	-2,203	-1,845	-832	-1,086	-14,403
	Ave Δ (2009-2012)	-6,439	-7,849	-1,402	163	-1,188	-134	-16,848

Table 14. Estimated 2009 (Revised)-2012 Shrimp Otter Trawl Effort (Days Fished) by Season, Depth Stratum, and South Atlantic Sub-Region.

		Season				
		Summer (Mar-Nov)		Winter (Dec-Feb)		Summer/Winter Combined
		Depth Stratum		Depth Stratum		
Region	Year	Inshore*	Ocean	Inshore*	Ocean	Both Depth Strata Combined
South (Zones 24-30)	2009	517	4,254	138	1,433	6,342
	2010	530	3,969	106	1,718	6,323
	2011	639	5,256	258	2,466	8,618
	2012	905	4,391	215	2,596	8,107
	Δ (2009, 2010)	13	-285	-32	285	-19
	Δ (2009, 2011)	122	1,002	120	1,032	2,276
	Δ (2009, 2012)	388	138	77	1,163	1,766
	Ave Δ (2009-2012	174	285	55	827	1,341
Central (Zones 31-33)	2009	3,014	6,472	310	888	10,683
	2010	3,930	8,840	290	1171	14,231
	2011	2,860	7,222	165	1007	11,254
	2012	3,913	8,323	194	631	13,061
	Δ (2009, 2010)	916	2,368	-20	284	3,548
	Δ (2009, 2011)	-154	751	-145	120	571
	Δ (2009, 2012)	899	1,852	-116	-257	2,377
	Ave Δ (2009-2012	554	1,657	-94	49	2,165
North (Zones 34+)	2009	6,843	1,823	34	164	8,864
	2010	6,437	1,532	16	128	8,113
	2011	4,992	1,282	35	135	6,444
	2012	7,013	1,659	51	140	8,863
	Δ (2009, 2010)	-406	-291	-18	-36	-751
	Δ (2009, 2011)	-1,851	-541	1	-29	-2,420
	Δ (2009, 2012)	170	-164	17	-24	-1
	Ave Δ (2009-2012	-696	-332	0	-30	-1,057
All Zones	2009	10,374	12,548	482	2,485	25,889
	2010	10,897	14,341	412	3,017	28,667
	2011	8,491	13,760	458	3,608	26,316
	2012	11,831	14,373	460	3,367	30,031
	Δ (2009, 2010)	523	1,793	-70	532	2,778
	Δ (2009, 2011)	-1,883	1,212	-24	1,123	428
	Δ (2009, 2012)	1,457	1,825	-22	882	4,142
	Ave Δ (2009-2012	32	1,610	-39	846	2,449
*Inshore refers to waters inside the COLREG lines, bays, and sounds)						

In calculating effort estimates through 2012, the SEFSC followed the same methodology that was used previously for analyses in Epperly et al. (2002b) and the May 2012 opinion except for the details of the estimation of Atlantic effort as documented in Appendix 6. Epperly et al.

(2002b) described in detail how Gulf effort (hours fished) and Atlantic effort (number of trips and days fished) were calculated for 2001 based on available data and the associated sources of error.

Effort can be expressed in units of trips, days, or hours. The best available estimates of shrimp effort are for days fished in the Gulf of Mexico and trips fished in the South Atlantic. Gulf of Mexico effort data are collected as hours fished based on captain interviews and electronic logbook data. In the South Atlantic, individual state trip ticket systems are used, thus fishing trip is the basic sampling unit for effort. While trip ticket systems generally do have fields to record duration of each trip on, those data are frequently missing or inconsistently reported as days and hours and not specified which). Thus, the methodology used to calculate days fished estimates for the South Atlantic necessitates additional assumptions and has greater sources of error than the methodology used to calculate Gulf of Mexico days fished because of the differences in data collection practices and data availability in each region. In Epperly et al. (2002b), "days fished" was used as the unit of effort for both regions because that is the format of the only sea turtle CPUEs available. However, in defining effort for our take surrogates in the May 2012 opinion, we used the "number of trips' in the South Atlantic to avoid introducing error associated with estimating hours fished.

Total otter trawl 2010, 2011, and 2012 effort levels in the Gulf of Mexico remained below 2009 otter trawl effort levels. Although effort in certain Gulf strata increased in 2010 (i.e., winter offshore in the Western Gulf and winter inshore in Eastern Gulf) and in 2011 (i.e., summer and winter offshore in the western Gulf, winter inshore in the Eastern and Western Gulf, and) overall otter trawl effort in the Gulf each year remained well below 2009 effort levels.

In the South Atlantic 2010, 2011, and 2012 otter trawl effort levels bounced up, down, and up again from 2009 effort levels. In addition to increases in effort in some strata as was documented in the Gulf, there was more effort overall in 2010 and in 2012 than in 2009. The overall South Atlantic effort over the 3-year period was higher than 2009 revised effort levels (+803 trips on average). The number of days fished per otter trawl trip in the Gulf of Mexico is highly variable, with anywhere from 10 to 40 days per trip typical and possibly some trips as long as 60 days (James Nance, SEFSC, pers. comm. to Jennifer Lee, SERO, via telephone on November 19, 2013.). In contrast, South Atlantic otter trawl trips are generally much shorter, with 3-5 day trips probably most typical, and some trips are even 1-day trips. Thus, despite the South Atlantic 2010-2012 average number of trips being greater than 2009 revised levels, gross comparison of South Atlantic trip data and Gulf of Mexico days fished data indicates overall 2010- 2012 otter trawl effort in the entire Southeast has likely remained below overall 2009 effort levels.

New TED Compliance Data Analysis and Results Relative to 2009 Capture Rate Baseline
Since completing the 2012 opinion, we have been monitoring otter trawl TED compliance and periodically conducting sea turtle capture rate analyses per the terms and conditions of the opinion's ITS requirements (i.e., using the same analysis methods as the effects analyses of the 2012 opinion). We now have nearly a year and half (i.e., June 2012 through October 2013) of new boarding data, analyses, and results.

In each of our new analyses, we followed the same basic 3-step process that we outlined in the 2012 opinion. First, we calculated compliance and non-compliance rates based on vessel boarding data from TED inspections conducted. Second, we estimated what sea turtle capture rates were on non-compliant vessels. Third, we combined documented compliance and non-compliance rates (step 1) with the results of our capture rate analyses for non-compliant vessels (step 2) to produce estimates of overall (i.e. fleet-wide) sea turtle capture rates.

In step 2 of the process, boarding records which had one or more violations and sufficient violation details to evaluate their impacts on capture rates were used. For each boarding record used, SEFSC gear experts identified the most egregious violation by TED component (e.g., TED grid angle, escape opening dimension, escape flap configuration, etc.) and then assigned the associated level of severity and % probability of capture (i.e., a 3, 10, 30, 50, 60, 70, 80, 90, or 100% capture rate) relative to sea turtle size. Probabilities of capture were applied to two size-groups of sea turtles which are known to be encountered in the shrimp otter trawl 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).

In Table 15, we present the different types and severity levels of violations and the capture probabilities assigned to each sea turtle size that we used. For example, a TED angle of 65 degrees was scored as having a 90% probability of capturing a sea turtle in the small-size group and a 60% probability of capturing a sea turtle in the large-size group. A 3% capture rate was applied for technical minor violations that were unlikely to increase sea turtle capture rates. All of the capture probabilities were derived from the following: TED testing observations through 2012 during which small (26.5 to 39 cm SCL) juvenile loggerheads were exposed to various configurations of non-compliant TEDs, TED testing (diver-assisted) assessments of a leatherback surrogate model passing through non-compliant TED configurations, and expert opinion of SEFSC gear technicians.

In step 3 of the process we used the following equation to calculate overall sea turtle capture rates of each size category (i.e., small and large sea turtles): [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. We then calculated the overall average sea turtle capture rate by taking the average of the two size classes. To increase our boarding sample size, we used both OLE and GMT vessel boarding data in our analyses instead of just OLE boarding data as done previously.

Monthly, 6-month aggregate, and estimates for the entire first year were initially produced in each step in the process. We later analyzed June 2013 through October 2013 and the entire post-opinion data set (i.e., June 2012 through October 2013) in the same manner. Southeast boarding data were initially pooled and analyzed and then later broken out by Gulf and South Atlantic Region and analyzed separately.

Table 15. Violation and Capture Rate Matrix (see preceding text for explanation of data sources).

TED COMPONENT	VIOLATION TYPE	VIOLATION SEVERITY LEVEL			
		LEVEL 1 [a]	LEVEL 2 [b]	LEVEL 3 [c]	LEVEL 4 [d]
TED Angle	Angle > 55° from horizontal	55.1° to 57.9°	58.0° to 60.9°	61.0° to 70.9°	≥ 71.0°
	Capture Rate A [e], Capture Rate B [f]	3%, 3%	70%, 30%	90%, 60%	100%, 100%
Double cover	Overlap > 15-inch (in.) min.	15.1-16.0 in	16.1-17.9 in.	18.0-19.9 in.	≥ 20.0 in.
	Capture Rate A, Capture Rate B	3%, 3%	50%, 10%	80%, 50%	100%, 80%
	Forward Cut < 20-in. min.	19.0-19.9 in.	16.0-18.9 in.	< 16.0 in.	X
	Capture Rate A, Capture Rate B	3%, 3%	10%, 80%	30%, 100%	--, --
	Leading Edge Cut < 56-in. min.	54.0-59.9 in.	52.0-53.9 in.	< 52.0 in.	X
	Capture Rate A, Capture Rate B	3%, 3%	50%, 10%	80%, 50%	--,--
	Flap Attachment > 24-in. max.	24.1-36.0 in.	> 36 in.	X	X
	Capture Rate A, Capture Rate B	3%, 3%	50%, 10%	--, --	--, --
71-Inch Opening	Forward Cut < 26-in. min.	18.0-25.9 in	16.0-17.9 in.	< 16.0 in.	X
	Capture Rate A, Capture Rate B		10%, 80%	30%, 100%	--, --
	Leading Edge Cut < 71-in. min.	54.0-70.9 in.	52.0-53.9 in.	< 52.0 in	X
	Capture Rate A, Capture Rate B	3%, 3%	10%, 80%	30%, 100%	--, --
	Escape Opening < 71-in. min.	64.0-70.9 in.	44.0-63.9 in.	18.0-43.9 in.-	< 18.0 in
	Capture Rate A, Capture Rate B	3%, 3%	10%, 80%	30%, 100%	50%, 100%
	Flap Attachment > 6.0 in. beyond edge of grid	6.1-12.0 in.	≥ 12.1 in.	X	X
	Capture Rate A, Capture Rate B	3%, 3%	10%, 80%	--, --	--, --
	Flap Length > 24.0 in. beyond edge of grid	24.1-36.0 in.	≥ 36.1 in.	X	X
	Capture Rate A, Capture Rate B	3%, 3%	10%, 80%	--, --	--, --
44-Inch Opening	Escape Opening < 44-in. min.	42.0-43.9 in. Horiz. 15.0-19.9 in. Vert.	34.0-41.9 in. Horiz. 10.0-14.9 in. Vert.	24.0-33.9 in. Horiz. 4.0-9.9 in. Vert.	< 24.0 in. Horiz. < 4.0 in Vert.
	Capture Rate A, Capture Rate B	3%, 3%	10%, 50%	30%, 70%	70%, 100%
Bar Spacing	Bent bar spacing > 4.0 in.	4.1-5.9 in.	6.0-7.9 in.	≥ 8.0 in; bar missing	X
	Capture Rate A, Capture Rate B	3%, 3%	30%, 30%	70%, 30%	--, --
Netting	Hole or gap in TED Netting	< 2.0 in.	2.0-3.9 in.	≥ 4.0 in.	X
	Capture Rate A, Capture Rate B	3%, 3%	30%, 30%	70%, 30%	--, --
Bottom Shooting TED Flotation	Float violation		Undersized floats	Insufficient #	No floats
	Capture Rate A, Capture Rate B		30%, 30%	70%, 30%	100%, 100%
NA	TED sewn or fastened shut				100%

a - Level 1 discrepancies are unlikely to capture more sea turtles than vessels with fully compliant TEDs; b - Level 2 discrepancies are likely to capture more sea turtles than vessels with fully compliant TEDs; c - Level 3 discrepancies are likely to capture most sea turtles encountered; d -Level 4 discrepancies are likely to capture all sea turtles encountered; e - Capture Rate A=Capture rate estimate for small-size group ;f – Capture Rate B=Capture rate estimate for large-size group

June 2012 through October 2013 TED inspection and compliance levels are presented in Table 16 by month, 6-month aggregate, first full year, most recent data, and all combined, for the entire Southeast Region (denoted in tables as "all") and for Gulf and South Atlantic sub-regions (i.e., the results of step 1). Between June 2012 and October 2013, OLE and/or GMT inspected 595 vessels which were required to use TEDs. Nearly 64% of all of the boardings conducted were in the Gulf (217 vessels in the South Atlantic and 378 vessels in the Gulf). The total number of boardings per month ranged from 1 to 109 (1 to 38 in the South Atlantic, 1 to 104 in the Gulf), with a monthly average of 35 boardings (13 boardings in the South Atlantic and 22 in the Gulf). 62% (n=255) of the total number of boardings occurred during the first six months, of which 76% (n=194) were conducted in the Gulf. Very few boardings (i.e., 10 total) were conducted October 2012 through January 2013. Average TED compliance rates in the entire Southeast and in the Gulf were higher during the first six months than the second six months (78% versus 60% in the entire Southeast, 83% versus 58% in the Gulf). There were 20% more boardings in the South Atlantic during the second six-month period than in the first, but the average compliance rate in the South Atlantic was the same (i.e., 62% for both June through November and December through May). TED compliance rates in the entire Southeast and in both regions have been highest during the past five months (83% in the entire Southeast, 81% in the South Atlantic and 83% in the Gulf).

Table 16. June 2012-October 2013 TED Compliance Based on Vessel Boarding Data

Month	Number of Vessels Inspected For TED Compliance			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			Percent of Vessels Inspected That Were Found Fully Compliant			Percent of Vessels Inspected That Were Found Non-Compliant		
Southeast Area	**All**	**SA**	**Gulf**	**All**	**SA**	**Gulf**	**All**	**SA**	**Gulf**	**All**	**SA**	**Gulf**	**All**	**SA**	**Gulf**
Jun. 2012	70	6	64	20	1	19	50	5	45	71	83	70	2	17	30
Jul. 2012	109	5	104	11	0	11	98	5	93	90	100	89	10	0	11
Aug. 2012	48	23	25	9	7	2	39	16	23	81	70	92	19	30	8
Sep. 2012	23	22	1	15	14	1	8	8	0	35	36	0	65	64	100
Oct. 2012	2	2	0	1	1	na	1	1	na	50	50	na	50	50	na
Nov. 2012	3	3	0	0	0	na	3	3	na	100	100	na	0	0	na
Dec. 2012	4	0	4	3	na	3	1	na	1	25	na	25	75	na	75
Jan. 2013	1	1	0	1	1	na	0	0	na	0	0	na	100	100	na
Feb. 2013	38	38	0	15	15	na	23	23	na	61	61	na	39	39	na
Mar. 2013	40	0	40	17	na	17	23	na	23	58	na	58	43	na	43
Apr. 2013	66	36	30	25	13	12	41	23	18	62	64	60	38	36	40
May 2013	8	1	7	2	0	2	6	1	5	75	100	71	25	0	29
Jun. 2013	43	10	33	8	1	7	35	9	26	81	90	79	19	10	21
Jul. 2013	89	28	61	10	3	7	79	25	54	89	89	89	11	11	11
Aug. 2013	32	32	0	5	5	na	27	27	na	84	84	na	16	16	na
Sep. 2013	12	10	2	6	6	0	6	4	2	50	40	1	50	60	0
Oct. 2013	7	0	7	3	na	3	4	na	4	57	na	57	43	na	43
Jun. 2012 - Nov. 2012: 1st 6-mos	255	61	194	56	23	33	199	38	161	78	62	83	22	38	17
Dec.2012 -May 2013: 2nd 6-mos.	157	76	81	63	29	34	94	47	47	60	62	58	40	38	42
Jun.2012- May 2013: 1st year	412	137	275	119	52	67	293	85	208	71	62	76	29	38	24
Jun.2013- May 2013: Most recent	183	80	103	32	15	17	151	65	86	83	81	83	17	19	17
May 2012- Oct.2013: All combined	595	217	378	151	67	84	444	150	294	75	69	78	25	31	22

Na=not applicable, no vessels inspected on which to base results.

We present the results of our capture rate analyses for non-compliant vessels by month for the entire Southeast Region and for Gulf and South Atlantic sub-regions (i.e., step 2) in Tables 17-22. The severity of TED violations varied from very minor violations having no effect on sea turtle capture rates (e.g., a TED angle of 56 degrees) to severe violations that would completely compromise the TED's ability to release sea turtles (e.g., a TED angle of 71 degrees). Most of the severe violations were angle violations; there was only one vessel that did not have a TED and none that had a TED sewn shut. Estimated weighted capture rates in the Southeast each month ranged from 28% to 63% (28% to 61% in the South Atlantic, 37% to 61% in the Gulf) for small turtles and from 19% to 57% (19% to 49% in the South Atlantic, 31% to 57% in Gulf) for large turtles. There were many months where we did not calculate a monthly weighted average for the Gulf or the South Atlantic because we had less than five boardings, and between October and January we did not have enough records to calculate weighted averages even for the Southeast. With only two months with boarding sample size over 20, it is more than likely the variation in monthly sea turtle capture rates is just an artifact of the small sample sizes rather than actual fleet variation from month to month.

In Tables 23 and 24, we present the 6-month aggregate, first full year, most recent data, and all data-combined results. Looking just at the sea turtle capture rates by size category results of our two 6-month reviews, it appears that the severity of the violations documented was relatively consistent throughout the Southeast during the first six months (i.e., estimated small sea turtle capture rates of 51% in the South Atlantic, 50% in the Gulf, and 50% for the entire Southeast; estimated large sea turtle capture rates of 42% in the South Atlantic, 45% in the Gulf, and 44% for the entire Southeast). The violations documented during the second six-month period were slightly less severe (i.e., estimated small sea turtle capture rates of 45% in the South Atlantic, 41% in the Gulf, and 50% for the entire Southeast; estimated large sea turtle capture rates of 33% in the South Atlantic, 19% in the Gulf, and 34% for the entire Southeast). The severity of violations documented via the most recent data though is basically the same as it was for the first six-month period, and there are no substantial changes in the average severity of violations documented for each size class between any of the time-periods analyzed. However, the types of violation documented during each time period analyzed were generally always worse for small sea turtles than for large sea turtles (i.e. small sea turtle estimated capture rates were consistently greater than for large sea turtles).

Table 17. Estimated Capture Rates of Non-Compliant Vessels for Small Sea Turtles (i.e., Kemp's Ridley Sea Turtles and Juvenile Loggerhead and Green Sea Turtles) from June through November 2012 By Area and Month.

Capture Rate	June 2012			July 2012			August 2012			September 2012			October 2012			November 2012		
	All n=20	SA n=1	Gulf n=19	All n=11	SA n=0	Gulf n=11	All n=9	SA n=7	Gulf n=2	All n=15	SA n=14	Gulf n=1	All n=1	SA n=1	Gulf na	All n=0	SA n=0	Gulf na
3	5	0	5	4	0	4	6	5	1	4	3	1	0	0	-	0	0	-
10	0	0	0	0	0	0	0	0	0	1	1	0	0	0	-	0	0	-
30	1	0	1	4	0	4	0	0	0	1	1	0	0	0	-	0	0	-
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	-
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	-
70	4	0	4	0	0	0	1	0	1	4	4	0	0	0	-	0	0	-
80	0	0	0	0	0	0	0	0	0	1	1	0	0	0	-	0	0	-
90	6	0	6	2	0	2	2	2	0	2	2	0	1	1	-	0	0	-
100	4	1	3	1	0	1	0	0	0	2	2	0	0	0	-	0	0	-
Weighted Ave (%)	63	na	61	37	na	37	30	28	na	53	56	na	na	Na	na	na	na	-

n=number of boarded non-compliant vessels; na= not applicable because there were no vessels inspected or too few data for a meaningful result

Table 18. Estimated Capture Rates of Non-Compliant Vessels for Small Sea Turtles (i.e., Kemp's Ridley Sea Turtles and Juvenile Loggerhead and Green Sea Turtles) from December 2012 through May 2013 By Area and Month.

Capture Rate	December 2012			January 2013			February 2013			March 2013			April 2013			May 2013		
	All, n=3	SA na	Gulf n=3	All n=1	SA n=1	Gulf Na	All n=15	SA n=15	Gulf na	All n=17	SA na	Gulf n=17	All n=25	SA n=13	Gulf n=12	All n=2	SA n=0	Gulf n=2
3	1	-	1	0	0	-	9	9	-	4	-	4	7	3	4	2	-	2
10	0	-	0	0	0	-	1	1	-	4	-	4	0	0	0	0	-	0
30	0	-	0	0	0	-	0	0	-	1	-	1	1	1	0	0	-	0
50	0	-	0	0	0	-	0	0	-	3	-	3	3	1	2	0	-	0
60	0	-	0	0	0	-	0	0	-	0	-	0	0	0	0	0	-	0
70	1	-	1	1	1	-	3	3	-	1	-	1	3	1	2	0	-	0
80	0	-	0	0	0	-	0	0	-	1	-	1	0	0	0	0	-	0
90	1	-	1	0	0	-	2	2	-	2	-	2	8	6	2	0	-	0
100	0	-	0	0	0	-	0	0	-	1	--	1	3	1	2	0	-	0
Weighted Ave (%)	na	-	na	na	na	-	28	28	-	39	-	39	57	61	53	na	-	na

n=number of boarded non-compliant vessels; na= not applicable because there were no vessels inspected or too few data for a meaningful result

Table 19. Estimated Capture Rates of Non-Compliant Vessels for Small Sea Turtles (i.e., Kemp's Ridley Sea Turtles and Juvenile Loggerhead and Green Sea Turtles) from June 2013 through October 2013 By Area and Month.

Capture Rate	June 2013			July 2013			August 2013			September 2013			October 2013		
	All n=8	SA n=1	Gulf n=7	All n=10	SA n=3	Gulf n=7	All n=5	SA n=5	Gulf n=na	All n=6	SA n=6	Gulf n=0	All n=3	SA n=na	Gulf n=3
3	2	0	2	3	1	2	3	3	-	2	2	-	2	-	2
10	1	0	1	0	0	0	0	0	-	0	0	-	0	-	0
30	1	0	1	0	0	0	0	0	-	0	0	-	0	-	0
50	0	0	0	0	0	0	0	0	-	0	0	-	0	-	0
60	0	0	0	0	0	0	0	0	-	0	0	-	0	-	0
70	1	0	1	2	2	0	2	2	-	1	1	-	1	-	1
80	0	0	0	0	0	0	0	0	-	0	0	-	0	-	0
90	0	0	0	4	0	4	0	0	-	2	2	-	0	-	0
100	3	1	2	1	0	1	0	0	-	1	1	-	0	-	0
Weighted Ave (%)	52	na	45	61	48	67	30	30	-	59	59	-	na	-	na

n=number of boarded non-compliant vessels; na= not applicable because there were no vessels inspected or too few data for a meaningful result

Table 20. Estimated Capture Rates of Non-Compliant Vessels for Large Sea Turtles (i.e., Leatherback, Adult Loggerhead, and Adult Green Sea Turtles) in the Southeast Region from June Through November 2012 By Area and Month.

Capture Rate	June 2012			July 2012			August 2012			September 2012			October 2012			November 2012		
	All n=20	SA n=1	Gulf n=19	All n=11	SA n=0	Gulf n=11	All n=9	SA n=7	Gulf n=2	All n=15	SA n=14	Gulf n=1	All n=1	SA n=1	Gulf na	All n=0	SA n=0	Gulf na
3	5	0	5	4	0	4	6	5	1	4	3	1	0	0	-	0	0	-
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	-
30	5	0	5	0	0	0	1	0	1	4	4	0	0	0	-	0	0	-
50	0	0	0	0	0	0	0	0	0	1	1	0	0	0	-	0	0	-
60	6	0	6	2	0	2	2	2	0	2	2	0	1	0	-	0	0	-
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	-
80	0	0	0	0	0	0		0	0	1	1	0	0	0	-	0	0	-
90	0	0	0	0	0	0	0	0	0	0	0	0	0	1	-	0	0	-
100	4	1	3	5	0	5	00	0	0	3	3	0	0	0	-	0	0	-
Weighted Ave (%)	46	na	43	57	na	57	19	19	na	45	49	na	na	na	-	na	na	-

n=number of boarded non-compliant vessels; na= not applicable because there were no vessels inspected or too few data for a meaningful result

Table 21. Estimated Capture Rates of Non-Compliant for Large Sea Turtles (i.e., Leatherback, Adult Loggerhead, and Adult Green Sea Turtles) from December 2012 Through May 2013 By Area and Month.

Capture Rate	December 2012			January 2013			February 2013			March 2013			April 2013			May 2013		
	All n=3	SA na	Gulf n=3	All n=1	SA n=1	Gulf na	All n=15	SA n=15	Gulf na	All n=17	SA n=na	Gulf n=17	All n=25	SA n=13	Gulf n=12	All n=2	SA n=0	Gulf n=2
3	1	-	1	0	0	-	9	9	-	4	-	4	7	3	4	2	0	2
10	0	-	0	0	0	-	0	0	-	3	-	3	3	1	2	0	0	0
30	1	-	1	1	1	-	3	3	-	1	-	1	3	1	2	0	0	0
50	0	-	0	0	0	-	0	0	-	1	-	1	0	0	0	0	0	0
60	1	-	1	0	0	-	2	2	-	2	-	2	8	6	2	0	0	0
70	0		0	0	0	-	0	0	-	0	-	0	0	0	0	0	0	0
80	0	-	0	0	0	-	1	1	-	5		5	2	0	2	0	0	0
90	0	-	0	0	0	-	0	0	-	0	-	0	0	0	0	0	0	0
100	0	-	0	0	0	-	0	0	-	1	-	1	2	2	0	0	0	0
Weighted Ave (%)	na	-	na	*	*	-	21	21	-	44	-	44	39	47	31	na	0	na

n=number of boarded non-compliant vessels; na= not applicable because there were no vessels inspected or too few data for a meaningful result

Table 22. Estimated Capture Rates of Non-Compliant for Large Sea Turtles (i.e., Leatherback, Adult Loggerhead, and Adult Green Sea Turtles) from June 2013 Through October 2013 By Area and Month.

Capture Rate	June 2013			July 2013			August 2013			September 2013			October 2013		
	All n=8	SA n=1	Gulf n=7	All n=10	SA n=3	Gulf n=7	All n=5	SA n=5	Gulf n=na	All n=6	SA n=6	Gulf n=0	All n=3	SA n=na	Gulf n=3
3	2	0	2	3	1	2	3	3	-	2	2	0	2	-	2
10	0	0	0	0	0	0	0	0	-	0	0	0	0	-	0
30	1	0	1	2	0	0	2	2	-	1	1	0	1	-	1
50	0	0	0	0	0	0	0	0	-	0	0	0	0	-	0
60	0	0	0	4	0	4	0	0	-	2	2	0	0	-	0
70	0	0	0	0	2	0	0	0	-	0	0	0	0	-	0
80	1	0	1	0	0	0	0	0	-	0	0	0	0	-	0
90	0	0	0	0	0	0	0	0	-	0	0	0	0	-	0
100	4	1	3	1	0	1	0	0	-	1	1	0	0	-	0
Weighted Ave (%)	65	na	59	41	na	49	14	14	-	43	43	na	na	-	na

n=number of boarded non-compliant vessels; na= not applicable because there were no vessels inspected or too few data for a meaningful result

Table 23. Estimated Average Sea Turtle Capture Rates of Non-Compliant Vessels for Small Sea Turtles (Kemp's Ridley, Juvenile Loggerhead, and Juvenile Green Sea Turtles).

Capture Rate	Jun. 2012- Nov. 2012: 1st 6-mo. review			Dec. 2012- May2013: 2nd 6-mo. review			Jun. 2012- May 2013: 1st year post 2012 opinion			Jun. 2013- Oct. 2013: most recent data			Jun. 2012- Oct. 2013: All post-2012 opinion data		
	All n=56	SA n=23	GOM n=33	All n=63	SA n=29	GOM n=34	All n=119	SA n=52	GOM n=67	All n=32	SA n=15	GOM n=17	All n=151	SA n=67	GOM n=84
3	19	8	11	23	12	11	42	20	22	12	6	6	54	26	28
10	1	1	0	5	1	4	6	2	4	1	0	1	7	2	5
30	6	1	5	2	1	1	8	2	6	1	0	1	9	2	7
50	0	0	0	6	1	5	6	1	5	0	0	0	6	1	5
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	9	4	5	9	5	4	18	9	9	7	5	2	25	14	11
80	1	1	0	1	0	1	2	1	1	0	0	0	2	1	1
90	13	5	8	13	8	5	26	13	13	6	2	4	32	15	17
100	7	3	4	4	1	3	11	4	7	5	2	3	16	6	10
Weighted Ave (%)	50	51	50	50	45	41	47	46	47	50	50	50	48	48	47

Table 24. Estimated Average Sea Turtle Capture Rates of Non-Compliant Vessels for Large Sea Turtles (Leatherback, Adult Loggerhead, and Adult Green Sea Turtles).

Capture Rate	Jun. 2012- Nov. 2012: 1st 6-mo. review			Dec. 2012- May2013: 2nd 6-mo. review			Jun. 2012- May 2013: 1st year post 2012 opinion			Jun. 2013- Oct. 2013: most recent data			Jun. 2012- Oct. 2013: All post-2012 opinion data		
	All n=56	SA n=23	GOM n=33	All n=63	SA n=29	GOM n=34	All n=119	SA n=52	GOM n=67	All n=32	SA n=15	GOM n=17	All n=151	SA n=67	GOM n=84
3	19	8	11	23	12	11	42	20	22	12	6	6	54	26	28
10	0	0	0	6	1	5	6	1	5	0	0	0	6	1	5
30	10	4	6	9	5	4	19	9	10	7	3	2	26	12	12
50	1	1	0	1	0	1	2	1	1	0	0	0	2	1	1
60	13	5	8	13	8	5	26	13	13	6	2	4	32	15	17
70	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0
80	1	1	0	8	1	7	9	2	7	1	0	1	10	2	8
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	12	4	8	3	2	1	15	6	9	6	2	4	21	8	13
Weighted Ave (%)	44	42	45	34	33	19	39	37	40	40	38	47	39	37	42

Table 25. June through May Overall (Fleet-Wide) Capture Rates.

Month	Overall capture rate for all Kemp's ridley sea turtles and juvenile loggerhead and green sea turtles by region:			Overall capture rate for all leatherback sea turtle and adult loggerhead and green sea turtles by region:			Overall average sea turtle capture rate by Region:		
	All	**SA**	**Gulf**	**All**	**SA**	**Gulf**	**All**	**SA**	**Gulf**
Jun. 2012	20%	19%	20%	15%	19%	15%	18%	19%	18%
Jul. 2012	6%	3%	7%	8%	3%	9%	7%	3%	8%
Aug. 2012	8%	11%	6%	6%	8%	4%	7%	9%	5%
Sep. 2012	33%	37%	3%	33%	32%	3%	33%	34%	3%
Oct. 2012	*	47%	*	*	32%	*	*	*	*
Nov. 2012	*	3%	*	*	3%	*	*	*	*
Dec. 2012	*	0%	*	*	0%	*	*	*	*
Jan. 2013	*	0%	*	*	0%	*	*	*	*
Feb. 2013	13%	13%	*	10%	10%	*	12%	*	*
Mar. 2013	18%	0%	18%	20%	0%	20%	19%		19%
Apr. 2013	24%	24%	23%	17%	19%	14%	20%	21%	19%
May 2013	3%	3%	3%	3%	3%	3%	3%	3%	3%
Jun. 2013	12%	13%	12%	14%	13%	15%	13%	13%	13%
Jul. 2013	10%	8%	10%	7%	8%	8%	8%	8%	9%
Aug. 2013	7%	7%	0%	5%	5%	0%	6%	6%	0%
Sep. 2013	31%	37%	3%	23%	27%	3%	27%	32%	3%
Oct. 2013	13%	0%	13%	7%	0%	7%	10%	0%	10%
Jun. 2012-Nov. 2012: 1st 6-month review	13%	21%	11%	12%	18%	10%	13%	19%	11%
Dec. 2012-May 2013: 2nd 6-month review	19%	19%	19%	16%	14%	17%	17%	17%	18%
Jun.2012-May 2013:1st year post 2012 opinion	16%	19%	14%	14%	16%	12%	15%	18%	13%
Jun. 2013-Oct. 2013: most recent data	11%	12%	11%	10%	10%	10%	10%	11%	11%
Jun. 2012- Oct. 2013: All post 2012 opinion data	14%	17%	13%	12%	13%	12%	13%	15%	12%

***= too few data to be meaningful.**

In Table 25, we present estimated overall (i.e. fleet-wide) small, large, and average sea turtle capture by month, 6-month aggregate, first full year, most recent data, and all data combined, for the entire Southeast Region and for Gulf and South Atlantic sub-regions. The overall average sea turtle capture rates in the entire Southeast were 1% higher than we anticipated for June 2012 through November 2012 and 5% higher than we anticipated for December 2012 through May 2013, thus averaging 3% higher than anticipated that first year. During June 2013 through October 2013, rates were 2% lower than the sea turtle capture rate standard, bringing up the average sea turtle capture rate for the entire data period (i.e., June 2012 through October 2013) to just 1% higher than anticipated. Gulf average sea turtle capture rates were 1% lower than the sea turtle capture rate standard during June through November in 2012 and June through October in 2013. The overall Gulf average sea turtle capture rate for December 2012 through May 2013 increased to 6% higher than anticipated, therefore the first year post the 2012 opinion had an average that was 1% higher than anticipated. However, the Gulf overall average sea turtle capture rate for the entire data period is right at the established standard. First and second 6-month review results for the South Atlantic average sea turtle capture rate were 7% and 5% higher than anticipated, thus the South Atlantic average sea turtle capture for the first year post the 2012 opinion had an average 6% higher than anticipated. However, the South Atlantic average sea turtle rate for June through October 2013 was 1% lower than the sea turtle capture rate standard, thus bringing the overall South Atlantic average sea turtle capture rate for the entire data period up to 3% higher than anticipated.

5.1.3.3 Discussion of Relevant New Otter Trawl Information since May 2012

Based on our review of 2010-2012 data, otter trawl effort in the Southeast over the past three years has generally remained below 2009 effort levels. There has been some fluctuation in effort from year to year in the South Atlantic with some years less than and some years more than 2009 effort levels.

Given the two main factors, high gas prices and competition from shrimp imports, that have been keeping shrimp otter trawl effort reduced are unlikely to change, otter trawl effort is not expected to increase substantially in the near future. Based on this information, we believe on average Southeast otter trawl effort in future years will also not be greater than effort in 2009, but that actual annual levels may continue to fluctuate from year to year within strata and from year to year, with some years exceeding 2009 effort levels.

Based on the results of our TED compliance and sea turtle catch rate analyses, average sea turtle capture rates in otter trawls between May 2012 and October 2013 were greater than the 12% sea turtle capture rate that we set as one of our take surrogates. Thus, even though effort during that time remained at or below 2009 levels, effects on sea turtles from shrimp otter trawls were likely greater than we anticipated in the first year that has elapsed since the opinion was completed.

The capture rate standard that we established in the May 2012 opinion was based on the extent of TED compliance that we anticipated. Because our jeopardy determination was based on not exceeding the levels analyzed in the opinion, we need to consider the effects on sea turtles from doing so. However, those levels were not an absolute rate that must be achieved to ensure that shrimp fisheries are not likely to jeopardize sea turtle populations. The system established in the 2012 opinion and described in Section 2.1.1 was set up in part to increase the effectiveness of TEDs in reducing sea turtle captures and mortality in otter trawls over the long term. In fact, that the fleet would exceed the 12% capture rate in some 6-month or annual time periods was anticipated to some extent as evident by the terms and conditions included in the opinion establishing corrective actions that would prevent the capture rate from being exceeded for much longer time-periods. Our ultimate goal was and remains to reduce sea turtle catch rates over the long-term.

As mentioned in our description of methods, our first 6-month analysis of sea turtle capture rates based on TED compliance in shrimp trawl fisheries was completed on both the South Atlantic and Gulf data combined, and when we reviewed the data for regional compliance differences per term and condition 9(a) we did not identify any. During the second 6-month review, we also analyzed sea turtle capture rates by region. In doing so, we discovered that the Gulf region had actually maintained sea turtle capture rates below 12% during the first six months and that it was South Atlantic compliance and associated violations that had led to exceeding the standard when pooling the data. Thus, we should have been directing more enforcement and outreach to the South Atlantic region than the general approach that was taken. Also in retrospect, this regional difference in compliance and sea turtle capture rates is not surprising considering increases in enforcement and outreach starting in 2011 targeted the Gulf of Mexico due to the increased strandings in the Northern Gulf.

After considering the estimated sea turtle capture rates achieved in 2012 and our efforts thus far under the new system to influence those rates (i.e., outreach levels, etc.), we believe that the 12% sea turtle capture rate represents a realistic estimate of a rate we can maintain and what is likely to occur in the future on a consistent basis, and it is not necessary to adjust our catch rate standard. Although we have not yet achieved our expected 12% capture rate we are very close to achieving this rate for the entire time series, and were below it for the most recent 6 month period.

There is no indication that compliance in 2012 and 2013 was worse than it had been in the past, aside from possibly during the May through August 2011 period when we had a sea turtle capture rate of 12% in the Gulf. In fact, the extensive GMT communication with industry, industry representatives, and law enforcement agencies indicates that their awareness of the new system and the importance of complying fully with the TED specifications has grown significantly over the past year. The number of boardings used to estimate sea turtle captures was considerably less than the number we analyzed in the 2012 opinion, particularly during the second half of the year. This brings us to question how representative the boarding data are of the entire fleet relative to that used in our 2012 opinion. The GMT is currently training SEFSC fishery observers how to measure and record TED data per a 2012 opinion requirement, and the goal is to use TED observer data to estimate sea turtle capture rates, to verify the representativeness of future boarding data, or both. However, presently this system is not in place; thus, the qualitative information we have indicating TED compliance is improving, cannot and should not be discounted.

5.1.3.4 Anticipated Future Trawl Interactions, Captures, and Mortality Estimates

In this section we present our estimates from the May 2012 opinion. We used the same calculations we used in the May 2012 opinion because, as stated in the preceding section, we do not believe our future effort will be higher than the 2009 effort and we are still anticipating a 12% average sea turtle capture rate.

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. (2002b) 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 (i.e., the 1997-1998 Foundation data) 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.

In the 2012 opinion, 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 (2002b) 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 the most recent year for which effort data were available at that time. 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 represented an annual increase of approximately 19% per year. For green sea turtles, because there are several source rookeries interacting with Southeast 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 assumed (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 were less certain and unremarkable, we used the same CPUEs as in Epperly et al. (2002b) without any population adjustment. Hawksbills were excluded from the analysis and addressed separately because there were no CPUE data for hawksbill, and interactions with the species were (are) believed to be very rare.

As noted earlier, there are no new sea turtle catch rate data on which to revise the sea turtle catch rates used in the 2012 opinion. Therefore, the sea turtle catch rates presented in Table 26 and 27 are unchanged from that opinion. We considered updating our scalars in this opinion to reflect that more time had elapsed during which Kemp's ridley and green sea turtle populations may have continued to increase and for which more recent effort data are available. However, we chose not to take that approach because of the 2010 DWH oil event, markedly low nesting levels of Kemp's ridley sea turtles and disruptions in usual shrimp trawling behavior and effort levels that year, and continued uncertainty in our scalar assumption of a one-to-one relationship between abundance and CPUE.

Table 26. 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 27. 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 based on 2009 effort data and CPUE data using the following equation: Interactions=CPUE species, strata, time,*effort strata, time.˙ The 2009 Gulf effort data used in our calculations was presented in Tables 12 of this opinion and is repeated below in Table 28. The 2009 South Atlantic effort used in our calculations is presented in Table 29, which is copied from 19 of the May 2012 opinion. The CPUE data used is presented in Tables 21 and 22. Tables 19 of the May 2012 opinion and not table 13 of this opinion was used because revisions were made to the South Atlantic South and Central zones data resulting in revised effort estimates for these zones (i.e., there were 88 fewer days fished in south zones and 857 fewer days fished in central zones. 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 already so no conversion was necessary. The results are presented in Table 30. Because the revised South Atlantic effort estimates were a little less than the estimates used in these calculations, the estimates are biased a little high.

Table 28. Estimated 2009 Gulf of Mexico Shrimp Otter Trawl Effort (24-hour days fished) by Season, Depth Zone, and Subegion.

Season	Depth	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 29. Estimated South Atlantic Shrimp Otter Trawl Effort (days fished) By Season, Depth Stratum, and Subregion as Reported in Table 19 of the May 2012 Opinion (Revised estimates from Table 13 are included in parenthesis for comparison purposes).

Season	Depth Zone	Subregion		
		South (zones 24-30	Central (zones 31-33)	North (zones 34-36
Summer (Mar.-Nov.	Inshore	590 (517)	3,447 (3,014)	6,843
	Ocean	4,253 (4,254)	6,762 (6,472)	1,823
Winter (Dec.-Feb.)	Inshore	152 (138)	383 (310)	34
	Ocean	1,435 (1,433)	948 (888)	164

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

Table 30. Estimated Otter Trawl Sea Turtle Interactions in 2012.

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 TED compliance and effectiveness future overall) by assuming a one-to-one relationship between expected vessel compliance and effort (e.g., if 85% of vessels were documented in compliance we would assume 85% of effort was from compliant vessels) and the overall extent of violations and effort (e.g., if 10% of non-compliant vessels boarded had violations in a particular category, we assumed 10% of non-compliant 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. (2002b) and reproduced in Table 31. The results are presented in Table 32.

Table 31. Proportion of Animals Retained in Trawls that Likely Drown by Area Sub-Region, Depth, and Season. Source: Epperly et al. (2002).

<table>
<tr><th rowspan="2">Area/Sub-Region</th><th rowspan="2">Depth Stratum</th><th colspan="2">Season</th></tr>
<tr><th>Summer</th><th>Winter</th></tr>
<tr><td rowspan="3">Eastern GOM</td><td>Inshore</td><td>0.8899</td><td>0.9842</td></tr>
<tr><td>Nearshore</td><td>0.8899</td><td>0.9842</td></tr>
<tr><td>Offshore</td><td>0.9351</td><td>0.9885</td></tr>
<tr><td rowspan="3">Western GOM</td><td>Inshore</td><td>0.9146</td><td>0.9826</td></tr>
<tr><td>Nearshore</td><td>0.9146</td><td>0.9826</td></tr>
<tr><td>Offshore</td><td>0.9588</td><td>0.9978</td></tr>
<tr><td rowspan="2">Atlantic North</td><td>Inshore</td><td>0.7303</td><td>0.8537</td></tr>
<tr><td>Ocean</td><td>0.7303</td><td>0.8537</td></tr>
<tr><td rowspan="2">Atlantic Central</td><td>Inshore</td><td>0.7303</td><td>0.8537</td></tr>
<tr><td>Ocean</td><td>0.7303</td><td>0.8537</td></tr>
<tr><td rowspan="2">Atlantic South</td><td>Inshore</td><td>0.4055</td><td>0.9930</td></tr>
<tr><td>Ocean</td><td>0.4055</td><td>0.9930</td></tr>
</table>

Table 32. 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

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

5.1.4.1 Overview of 2012 Analysis

In the 2012 opinion, NMFS (2012b), we estimated the number of interactions, captures, and mortalities in skimmer trawls, pusher-head trawls, and wing nets under the proposed action.

Interactions and capture estimates were calculated based on:

- Skimmer trawl sea turtle CPUEs for each species likely to interact with skimmer trawls that were derived from recent bycatch studies (i.e., Price and Gearheart (2011) for North Carolina and Scott-Denton et al. (2006) for the Gulf of Mexico) and species' relative abundances in STSSN inshore data
- 2009 effort levels in the Gulf (i.e., 24,399 days fished) and 2010 effort in North Carolina levels (1,096 trips), with the assumption that future effort would remain at or below those levels, and
- The expectation that TEDs would be required and that vessel compliance would be consistent with our predictions for the otter trawl fleet (i.e., compliance at a level that would maintain at least an 88% TED effectiveness rate).

To estimate total interactions and captures by skimmer trawls operating without TEDs for all sea turtle species, we derived species-specific CPUEs. In the Gulf of Mexico, Scott-Denton et al. (2006) only observed one green sea turtle capture. That capture was used to estimate a green sea turtle CPUE. For remaining sea turtle species in the Gulf of Mexico, each species' relative abundance in STSSN inshore strandings compared to green sea turtles was used as the basis for estimating their likely skimmer trawl CPUE. For example, if loggerheads were three times more abundant than greens, the loggerhead skimmer trawl CPUE would be three times higher than the green CPUE. The same approach was used in North Carolina, but the initial CPUE estimate was based on the capture of three Kemp's ridley sea turtles in North Carolina.

Estimated total mortalities of sea turtles were based on seasonal mortality rates derived from Sasso and Epperly (2006), which examined the effect of tow times in shrimp trawls on sea turtle mortality risk due to forced submergence. We estimated mortality rates assuming all skimmer trawl vessels were either operating under legal tow times or, conversely, for an average of 102 minutes.

Estimates were produced 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. However, because Florida regulations already require TEDs to be used by skimmer trawls in state waters, Florida skimmer trawls were excluded from our analysis. Additionally, for the purposes of the analysis, wing nets (butterfly nets), and pusherhead (chopstick) vessels were included in the bycatch estimates for Gulf of Mexico skimmer trawls.

5.1.4.2 Summary of New Skimmer Trawl Data Available Since May 2012

2012 Gulf of Mexico Sea Turtle CPUE, Mortality, and Tow Time Data
Starting in May 2012, observer effort was shifted from offshore otter shrimp trawl fisheries to Northern Gulf of Mexico inshore skimmer trawl fisheries to obtain more information on the potential impacts skimmer trawls have on sea turtle populations. Between May and July 2012 during 796 observed skimmer trawl tows, observers reported the capture of 24 sea turtles on skimmer trawl vessels, all of which were Kemp's ridley sea turtles. Tow times ranged from 24 to 128 minutes, with approximately 20% being over 70 minutes, with an average tow time of 57 minutes. Overall observed compliance with required tow times was 35%. All of the sea turtles were released alive. One sea turtle was initially comatose, but became active while on deck before release; five others were recorded as lethargic or slow. All observed sea turtles were small, juvenile specimens, and approximately 58% of these turtles had a body depth that could potentially allow them to pass sideways between the required maximum 4-inch bar spacing of a TED.

New Skimmer Trawl Effort Data Relative to Effort Baseline Established by NMFS (2012b)
Skimmer trawl effort data are now available through 2011. For comparison purposes, 2009, 2010, and 2011 data for the Gulf and North Carolina are all presented here in Table 33, along with the difference in effort from each baseline.

Table 33. 2009-2012 Skimmer Trawl Effort.[26]

Area	Unit of Effort	2009 (Baseline year for Gulf effort)	2010 (Baseline year for North Carolina effort)	2011	2012	Percent Change from Effort Baseline
Gulf of Mexico	Days fished	24,399	23,676	25,532	22,985	-3% in 2010, +5% in 2011

[26] The 2009 estimates were provided by James Nance, SEFSC to David Bernhart via attachment to a September 2, 2011 email, and the 2010-2012 estimates were provided by James Nance, SEFSC, to Jennifer Lee, SERO, via attachments to March 5, April 8, and November 1, 2013; and March 21, 2014, emails. The 2009-2012 estimates were provided by David Gloeckner, SEFSC, to Jennifer Lee via attachments to a November 15, 2013 email.

	Effort-hours	585,576	568,224	612,768	551,640	-6% in 2012
South Atlantic	Trips fished	807	1,096	330	1,088	-70% in 2011 -1% in 2012
	Effort-hours	4,842	6,576	1,980	6,528	

Gulf of Mexico effort in 2010 was 3% less than in 2009 (i.e., 723 fewer days fished or 17,352 fewer effort-hours in 2010 than in 2009). In 2011, it was 5% higher than in 2009 (i.e., 1,133 more days fished or 27,192 more effort-hours in 2011 than in 2009). In 2012, it then dropped to 6% lower than in 2009 (i.e., 1,414 fewer days fished or 33,939 fewer effort-hours in 2012). Average Gulf of Mexico effort for 2010-2012 (i.e., 24,064 days fished or 590,496 effort-hours) was less than 1% below the 2009 baseline (i.e., 330 fewer days fished or 8,040 few effort-hours). In the South Atlantic, we have two years of new data post the baseline that we can review (i.e., 2011 and 2012). Effort in 2011 was 70% less (i.e. 766 fewer days fished or 4,596 fewer effort-hours) than the 2010 effort baseline, but effort in 2012 was only approximately 1% less (i.e., 1088 trips or 6,528 effort-hours) than the 2010 effort baseline. Average South Atlantic effort for 2011 and 2012 (874 trips or 5,244 effort-hours) was 20% less (i.e., 222 fewer days fished or 1332 fewer effort-hours) than the 2010 effort baseline. Comparing effort-hour estimates across both regions, overall skimmer trawl effort in 2011 (614,748 effort-hours) and 2012 (558,168 effort-hours) was less than 1% higher (i.e., 22,596 more effort-hours) and less than 1% lower (33, 984 fewer effort hours), representatively, than the baseline (592,152 effort-hours in 2009/2010), and the average 2011-2012 effort (586,458 effort hours) was also less than 1% (5,694 fewer effort hours) than the baseline.

5.1.4. 3 Revised Skimmer Trawl Estimates Based on New Information Since May 2012

For this new opinion, we updated our skimmer trawl capture and mortality estimates from what we had in the May 2012 opinion to reflect:

- The 2012 sea turtle CPUE data for Gulf of Mexico skimmer trawls,
- That TEDS are not being implemented as assumed in NMFS (2012b) (i.e., skimmer trawls, pusher-head trawls, and wing nets will continue to fish without TEDs under tow times restrictions), and
- the extent of compliance with tow times in the Gulf based on 2012 observed levels.

For our North Carolina estimates, this involved essentially just reverting back to the status quo analysis (i.e., no TED requirement) that was presented in NMFS (2012b). For the Gulf of Mexico, we produced new estimates of sea turtle captures and mortalities in Gulf of Mexico skimmer trawl fisheries using the CPUE, observed mortality rate, and tow time compliance levels documented during the NMFS shrimp observer program 2012 summer observer coverage.

We considered updating our skimmer trawl estimates to also reflect the most recent effort data. However, in the 2012 opinion, we established effort baselines for the Gulf and South Atlantic which were comprised of both skimmer trawl and otter trawl effort. For skimmer trawls, we anticipated that effort would remain at or below 2009 skimmer trawl effort levels in the Gulf (i.e., 24,399 days fished) and 2010 skimmer trawl effort in North Carolina levels (1,096 trips). Based on available data, we still anticipate that to be the case in future years.

In 2011 there was record low North Carolina skimmer trawl effort (i.e., 330 trips), but in 2012 effort bounced back up to 1088 trips, just 8 trips less than the 2010 effort baseline established in the May 2012 opinion. In considering the new data, we reviewed the fishery's entire trip history (1994-2011) to see if there was any indication of a new trend. Our review showed an increasing trend in the number of trips in North Carolina between 1994 and 2002, but an overall declining trend since then. Our review also indicated there was a lot of year-to-year fluctuation. Given the fishery's history of effort fluctuations from year to year, it is likely that effort in North Carolina will bounce around some from year to year, but there is no indication of a new upward trend. Thus, to avoid underestimating future effort and therefore sea turtle impacts, we believe our best approach at this time is to maintain our North Carolina 2010 effort baseline rather than base future effort on one of the more recent data years.

In the Gulf of Mexico, effort bounced both below and above the effort baseline. However, average Gulf of Mexico effort for 2010-2012 (i.e., 24,064 days fished or 590,496 effort-hours) did remain below the 2009 baseline (i.e., 330 fewer days fished or 8,040 few effort-hours) and there is no evidence of a new increasing trend in effort. Thus, we believe our best approach at this time is to maintain the Gulf of Mexico 2009 effort baseline as our best prediction for future effort.

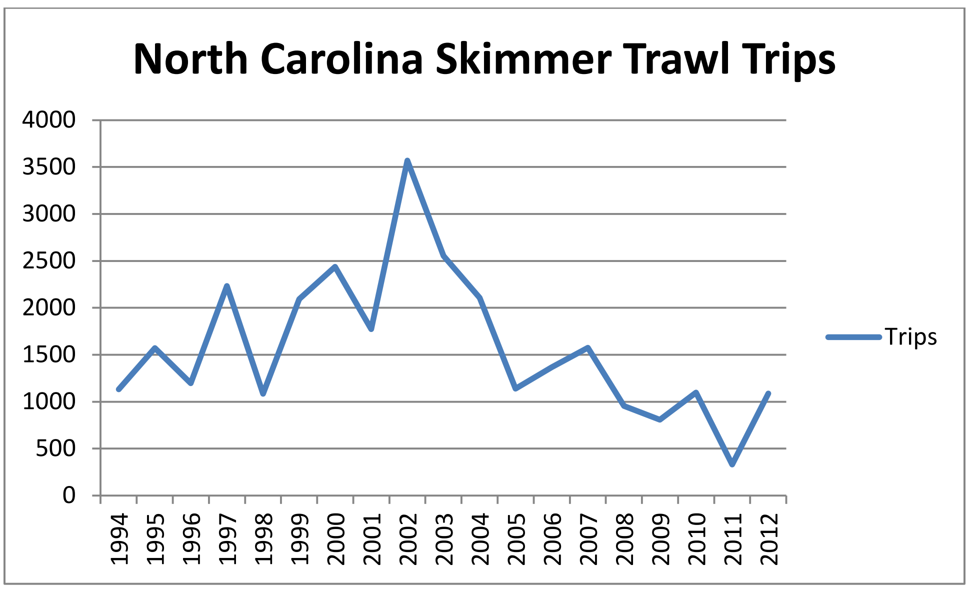

Figure 10. North Carolina Skimmer Trawl Trips (NCDMF License and Statistics Section 2013)

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 effects of skimmer trawl fishing, the 243 hours of total effort was adjusted by 50% 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 captures 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).

Although Price and Gearheart (2011) only observed Kemp's ridley sea turtle captures, we know other turtle species are present and likely to be encountered, and would expect them to be encountered were more effort sampled. Consequently, we think it would be unreasonable to rely on the lack of observed captures by Price and Gearhart and assume other species won't be captured in the future. Therefore, in the absence of other North Carolina skimmer trawl CPUEs 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 from 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% for Kemp's ridley, 28.89% for loggerhead, and 40% 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 34. The life history characteristics of leatherback sea turtles and the fact that leatherbacks are only rarely documented in inshore strandings records for North Carolina (e.g., none in 2011, 3 in 2012) lead 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 discounted and excluded from this analysis. In the continental U.S., hawksbill sea turtles occur along the eastern seaboard as far north as Massachusetts, but sightings north of Florida, are rare and off of North Carolina, there are no records of hawksbill sea turtles in inshore waters.

Table 34. 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 (2011 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
Hawksbill	X	0	0

In 2010, the North Carolina skimmer trawl fishery conducted 1,096 trips (NDMF License and Statistics Section 2013). 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% 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% of total trips and 1.85% of total estimated fishing effort conducted by the North Carolina skimmer trawl fishery in 2010.

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 35. 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 35. 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% 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.

Gulf of Mexico

Using the Kemp's ridley CPUE from the 2012 summer observer coverage (see Table 36),[27] we revised our estimates of sea turtle captures within the Gulf of Mexico skimmer trawl fisheries to reflect that TEDs will continue to not be required. Although the SEFSC only observed Kemp's ridley sea turtle captures, we know some other turtle species are present and likely to be encountered, and would expect them to be encountered were more effort sampled. Consequently, we think it would be unreasonable to rely on the lack of NMFS-observed captures and assume no other species would be captured in the future. Therefore, in the absence of other Gulf of Mexico skimmer trawl CPUEs, 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 sea turtle species relative abundances that were, in turn, used to extrapolate CPUE values for other sea turtle species. The resulting values are presented in Table 36. Leatherback sea turtles did not appear in the 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. Hawksbill sea turtles were also discounted because of their rarity in areas of the northern Gulf of Mexico where skimmer trawls are fished.

Table 36. CPUE Values and Relative Abundance of Sea Turtle Species for the Northern Gulf of Mexico.

Sea Turtle Species	Observed CPUE	Relative Abundance From STSSN (2010-2011 LA, MS, AL Inshore Strandings)	Extrapolated CPUE Values
Kemp's Ridley	0.03130	92.5	--
Loggerhead	x	3.5	0.00118
Green	x	4.0	0.00135
Leatherback	x	0	0
Hawksbill	x	0	0

The 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 ().[28] Using the estimated CPUE for Kemp's ridley sea turtles and the total estimated effort hours results in a total of 18,329 Kemp's ridley sea turtles captured by the Northern Gulf of Mexico skimmer trawl fisheries in 2009 (585,576 total effort hours x 0.03130 turtles/hour). Likewise, we estimated a total of 791 (585,576 total effort hours x 0.00135 turtles/hour) green sea turtles and 691 (585,576 total effort hours x 0.00118 turtles/hour) loggerhead sea turtles were captured in 2009.

[27] B. Ponwith, SEFSC, memorandum to R. Crabtree, SERO, dated September 21, 2012.
[28] The 2009 estimates were provided by James Nance, SEFSC to David Bernhart via attachment to a September 2, 2011 email

Estimating mortality

We estimated mortality for each season differently because we only had new observer data for the summer season. Our estimates for sea turtle mortality in the summer were based on the summer mortality rate (4.17%) derived from the 2012 Gulf of Mexico observer data. For the winter mortality estimates, because we did not have winter observer coverage, we conservatively assumed tow-time compliance was the same as documented in the summer via the observer coverage (i.e. 35% observed compliance with required tow times) and the winter mortality estimates from Sasso and Epperly (2006): 21.77% legal tow times and 49.68% long tow times. The resulting capture and mortality estimates for the Northern Gulf of Mexico skimmer trawl fishery are presented in Table 37.

Based on SEFSC guidance on how to utilize the 2012 observer data, we employed the observed summer mortality rate (i.e., 4.17%) to calculate estimated mortalities of sea turtles within the skimmer trawl fisheries operating without TEDs. While all 24 observed sea turtle captures were released alive, one turtle was originally boated in a comatose state. Based on National Research Council (1990) recommendations and SEFSC advice, this turtle was scored as a mortality to be conservative and account for real-world fishery conditions where turtles may not be properly resuscitated before being released.

Table 37. Revised Sea Turtle Capture and Mortality Estimates by Species in Gulf of Mexico Skimmer Trawls Based on 2012 Skimmer Trawl Observer Data.

Species	Estimated Captures	Estimated Mortalities
Kemp's Ridley	18,328	1,751
Loggerhead	691	66
Green	791	76
All Species Combined	19,810	1,893

It should be noted that there was considerable discussion within the agency on how the mortality of the observed sea turtles should be determined. We estimated mortality consistent with previous studies and biological opinions specific to the shrimp trawl fisheries. Alternative mortality estimation guidelines have been developed for other fisheries such as pelagic longline fisheries and NMFS Northeast Region trawl and gillnet fisheries. Guidelines for estimating sea turtle mortality in Northeast fishing gear were developed following a workshop conducted by the Northeast Fisheries Science Center in November 2009. The members of this workshop consisted of numerous subject matter experts, including veterinarians. As a result of the workshop, the Northeast Regional Office Protected Resources Division (NERO PRD) produced a memorandum to the file (Sea Turtle Serious Injury Determinations, March 28, 2012) implementing the recommendations of the workshop for federal fisheries in the Northeast. Use of these recommendations with the skimmer trawl data would have produced a significantly higher estimated mortality rate for the observed turtles. However, the SEFSC advised that determining mortality rates for the observed turtles based on the NERO memorandum in this particular case would be inappropriate because the information on sea turtle condition noted by the observers was not collected in a systematic and scientifically valid manner that would allow objective assessment against the workshop's injury categories. Considering the SEFSC's advice, the explicit limitation of the Northeast Fisheries Science Center's findings to Northeast fisheries, inconsistencies between the alternative mortality estimation schemes, and the large amount of empirical data and agency and scientific precedent supporting the use of our approach to mortality estimation in Southeastern shrimp fisheries, we believe that our fishery-specific approach to mortality estimation is presently the best-supported course.

North Carolina and the Gulf of Mexico Combined
Based on the results of the above analyses, we anticipate an estimated 20,332 total sea turtle captures and a maximum of 2,085 total sea turtle mortalities will result annually from Southeast skimmer trawl fisheries

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

Skimmer trawls, pusher-head trawls, and wing net (butterfly) trawls are not the only exceptions to the TED requirements. The proposed action would also continue to allow a shrimp trawler to use tow times in lieu of TEDs if (1) it 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) it has on board no powered or mechanical-advantage trawl retrieval system (i.e., any device used to haul any part of the net onboard; or (3) it 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 turtles 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% (n=7) of all sea turtles caught (n=293) were caught in try nets. In the Gulf, 6.66% (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% 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% 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 38).

Table 38. 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 (2002b) 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 and heavy with catch 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. (2002b) 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 total width. Epperly et al. (2002b) 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 hardbottom 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 (2002b) 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. We noted the above conclusions about each exempted gear and activity were based on knowledge of the gear and activities and the supposed and natural desired outcomes (i.e., bait shrimpers wanting live shrimp) and compliance with tow time restrictions. There have been no studies or comprehensive observer work done on these gears or activities to determine their actual effects on sea turtles, and we have no evidence or indication of them resulting in sea turtle mortalities. Thus, we believe their effects are inconsequential and do not increase mortalities associated with the proposed action to any measurable extent.

5.1.6 Summary and Review of Interaction, Capture, and Mortality Estimation Efforts for Loggerhead, Green, Leatherback, and Kemp's Ridley Sea Turtles

Producing bycatch estimates for fisheries as large and diverse as the Southeast 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 39 includes our estimates for the number of interactions, captures, and mortalities for otter trawls, skimmer trawls, and try nets in the Southeast Region, based on the best available information. These estimates are much higher than those estimated in NMFS (2002b) , even though shrimp fishing effort has substantially declined since 2001, and the SEFSC 2008 estimates (see Table 8). These estimates are also a bit higher than those in the 2012 opinion, which had overestimated the potential benefits of requiring TEDs in skimmer trawls (November 21, 2012, Decision Memorandum from Regional Administrator to the File).

Table 39. 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	993	1,209	0	18,652	20,854
	Try Nets	1,960	310	34	10,052	12,356
	All Gears Combined	81,358	13,910	1,427	430,787	527,482
Captures	Otter Trawl	9409	1487	167	48,250	59,313
	Skimmer Trawl	993	1,209	0	18,652	20,854
	Try Nets	1,960	310	34	10,052	12,356
	All Gears Combined	12,362	3,006	201	76,954	92,523
Mortalities	Otter Trawl	7,656	1,339	144	42,466	51,605
	Skimmer Trawl	122	114	0	1781	2,017
	Try Nets	0	0	0	0	0
	All Gears Combined	7,778	1,453	144	44,247	53,622

Two major processes are largely responsible for the increase in otter trawl interactions, captures, and mortalities compared to the 2002 and 2008 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% per year—19% based on updated model in NMFS et al. (2011b), 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% 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 (Harley et al. 2001; Hilborn and Walters 1992) and a number of factors have been reported to affect catchability (i.e., the constant that relates abundance to CPUE) (Maunder et al. 2006; Paloheirno and Dickie 1964; Rothschild 1977; Walters 2003). 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 are 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 sea turtle catch rate that drops rapidly because sea turtles are not instantaneously responding to maintain a uniform distribution in each strata.

Prior to the 2012 opinion, we developed sea turtle interaction, capture, and mortality estimates under the assumption that there would be 100% compliance with TED regulations and thus, that TEDs were 97% effective (i.e., a 3% sea turtle catch rate). In the 2012 opinion and this opinion, future interactions, captures, and mortalities assume compliance levels that would result in TEDs being 88% effective. This assumption is predicated on GMT and OLE boarding information used in present and future analyses being random and representative of the fleet, both in terms of the overall compliance rates and the extent of violations documented, despite being only a small subset of all shrimp otter trawl vessels.

Presently we have no way of testing our assumption that boarding data on TED compliance are representative of the fleet. Enforcement agents conduct boardings at particular times and in particular locations that are not usually random in nature. The logic underlying these decisions can vary depending on the available information (e.g. suspected problem areas, fishing effort data) and the desires of the boarding agents. In the 2012 opinion, based on our discussion with experienced GMT personnel and OLE agents at that time, we concluded we did not believe that 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. We noted that conversely the known presence of OLE in the area could affect the observed local compliance and result in actual higher boarding compliance rates compared to compliance rates of non-boarded vessels. As an example, we pointed out the potential for non-compliant vessels to be forewarned of an inspection patrol, i.e., radio communications between fishers, but such bias cannot be quantified. While that potential does still exist, boardings are not conducted as a randomized sampling program and instead are increasingly focused on efforts to address specific problem areas or intelligence and to effect change. In reconsidering this information and after further discussions with OLE, we believe compliance documented by OLE is much more likely to be less than overall fleet compliance. We are also concerned that the number of boardings over the past year might have been too small a sample to represent the entire fleet, especially considering this opinion's sample size is considerably less than what it was for the 2012 opinion.

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 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 CPUE (as adjusted for population growth) summarized in Table 9 of Epperly et al. (2002b) and using capture rates associated with best and average TED compliance rates observed by law enforcement.

Results summarized in Table 40 indicate that estimates of interactions, captures, and mortalities are all highly uncertain. Although it is unreasonable to assume that compliance is 100%, 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. Mortalities were estimated to range from 5,122 to 102,079 assuming no multiple recaptures. However, these estimates likely overestimate total captures and mortalities because sea turtles are known to interact with otter trawls multiple times. If two interactions per sea turtle capture are assumed, then the number of captures would be cut in half. 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 40. Results of Sensitivity Analyses of Kemp's Ridley Otter Trawl Interaction Estimates for the Gulf and Mexico and South Atlantic Combined.

If CPUE is assumed to be the:	And the compliance rate assumed is assumed to be…		Then…		
	In the Gulf of Mexico:	In the South Atlantic:	2009 Estimated Interactions are:	2009 Estimated Captures are	2009 Estimated Mortalities area
CPUE Mean	100%	100%	402,083	12,063	10,617
	2011 August Gulf compliance	2011 Aug Gulf compliance	402,083	25,769	22,680
	2011 Gulf Average compliance	2006-2011 SA Average compliance	402,083	73,341	62,263
CPUE Lower Confidence Level	100% compliance	100% compliance	193,410	5,802	5,122
	2011 Aug compliance	2011 Aug (in Gulf)	193,410	12,395	10,942
	2011 Gulf Average compliance	2006-2011 SA Average compliance	193,410	34,997	29,859
CPUE Upper Confidence Level	100%	100%	657,125	19,714	17,300
	2011 August Gulf compliance	2011 Aug Gulf compliance	657,125	42,114	36,957
	2011 Gulf Average compliance	2006-2011 SA Average compliance	657,125	120,834	102,079

Population trends were obtained from the USFWS and NMFS (2011b) Kemp's ridley population model. The current Kemp's ridley population model (NMFS et al. 2011b) 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% or 16% 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 period. 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 10. 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 (2011b) (Figure 11)

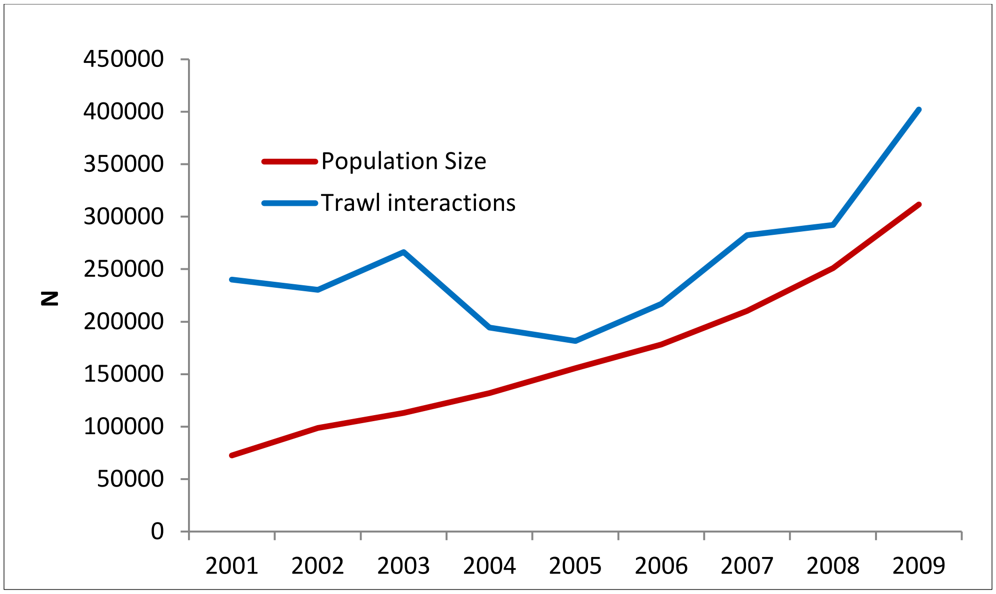

Figure 10. Comparison of Kemp's ridley population size estimates with otter trawl interaction estimates.

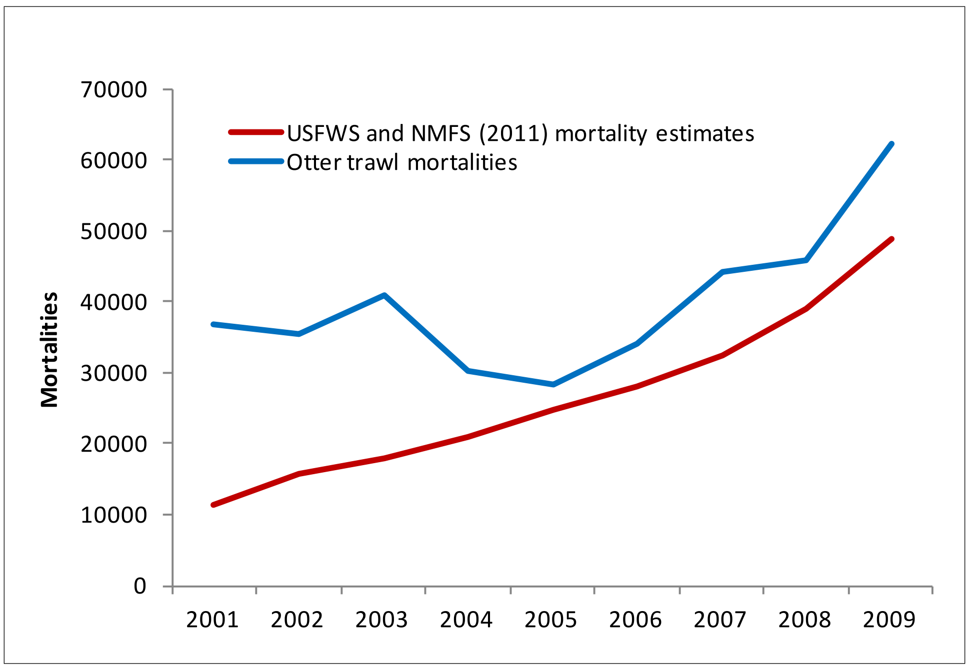

Figure 11. Gulf of Mexico and South Atlantic estimated Kemp's ridley otter trawl mortalities based on average CPUE and TED compliance rates, 2001-2009.

Our comparison reveals that otter 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 10). Similarly, otter trawl mortality estimates exceeded mortality estimates from the USFWS and NMFS Kemp's ridley population model (2011) in all years (Figure 11). 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 both population size and trawl mortality estimates are considerably uncertain, estimates presented herein appear to be unreasonably 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 the foregoing, we believe our bycatch estimates are unacceptably uncertain to rely on them extensively in analyzing impacts, despite being based on the best available information. The best available information is too uncertain to draw a reliable point estimate conclusion. However, our analyses demonstrate the relative impact that the extent of compliance with the TED regulations can have on sea turtle conservation.

5.1.7 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. Where hawksbills have the potential to co-occur with the shrimp fishery (primarily in southwest Florida and south Texas), there is the possibility of capture in trawls, and a few captures have been documented [e.g., (Epperly et al. 1995b),]. However, 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. (2002b) 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 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 extrapolating that number based on the assumption that strandings make up only 5 to 6% 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% effectiveness (meaning 3% of sea turtles will not escape). However, the estimated total hawksbill trawl interaction was between 17,767-21,333 (533/3% and 640/3%). 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 was not credible.

In the 2012 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.

With still no hawksbill CPUE data, we believe strandings remain the best data source on which to estimate interactions. Thus, here for this opinion we use the same approach and methods and just updated the data to include through 2010.

Table 41 shows the number of hawksbill sea turtle strandings in the Southeast from 1999-2010 that may be reasonably attributed to shrimp fisheries. Out of 528 hawksbill strandings over this 12-year period, 255 were estimated to reasonably be attributed to shrimp fisheries. The majority of these 255 sea turtles stranded dead, but a small number of live strandings each year were brought to rehabilitation 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, 4 in 2008, 3 in 2009, and 0 in 2010). Annual strandings that might be attributable to the shrimp fishery ranged from as few as 12 to as many as 40, and averaged 21 per year over the entire time period. Seventy percent of the records were from the Gulf, of which 70% were in Florida and 30% in Texas. In the South Atlantic, the vast majority were in Florida, with only three records in other states (2 in North Carolina, 1 in Georgia). 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 differed only slightly from the past 12-year average.

Table 41. 1999-2010 Hawksbill Sea Turtle Strandings in the Southeast That May Be Attributed to Shrimp Fisheries.

Year	Total	Gulf Total	FL Gulf	TX	S. Atl. Total	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
2009	17	10	7	3	7	7	0	0
2010	40	32	28	4	8	8	0	0
Total	255	179	126	53	76	73	2	1
Average all years	21.3	14.9	10.5	4.4	6.3	6.1	0.2	0.1
Average 2006-2010	21.8	15.2	11.2	4	6.6	6.2	0.2	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 (Epperly et al. 1996; Murphy and Hopkins-Murphy 1989). Studies of at-sea mortalities indicate stranding data only represent between 5% and 28% of all mortalities occurring at sea (Epperly et al. 1996; Hart et al. 2006; Murphy and Hopkins-Murphy 1989; TEWG 1998).

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% 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 1980s (1,191 to 2,373) to estimate that strandings represented from 3.6 (1,991/55,000) to 43.1% (2,373/55,000) of the total mortality. Based on the TEWG (1998) most likely estimates of 33,000 to 44,000, the estimated expansion factor is 5% to 6%. 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 the few that were not dead required rehabilitation, an estimate based on stranding data—and not non-lethal interactions—is most representative of the number of mortalities that occur. To address the potential under-representation of hawksbill mortalities by strandings associated with shrimp fisheries in this opinion, we chose to use 28% 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 shrimp fisheries is an average of 78 hawksbills per year (21.8/28%) or 390 hawksbills every 5 years. Although this methodology is less conservative than using the minimum of 5% to 6% as in NMFS (2002b) and used for stranding analyses for many other fisheries, we believe it is appropriate in this particular case. As stated earlier in this section and in Section 3.2.4 (Status of the Species), 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. Less often, hawksbill sea turtles can also inhabit seagrass pastures in mangrove-fringed bays and estuaries. The primary habitat differences between Hawksbill sea turtles and shrimp make it very unlikely that hundreds of hawksbill sea turtles are killed every year as the 5% scenario would predict. If hawksbill sea turtles were really interacting with shrimp trawls such that they were being killed so frequently, we would expect hawksbill catches to be at least occasionally 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.

5.1.8 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 Southeast 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 and 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 and at least hundreds and possibly thousands of those interactions are 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 even 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 hundreds, 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

In Sections 5.2.1- 5.2.3, we consider the effects on smalltooth sawfish of NMFS authorizing shrimp trawling in the EEZ. In Section 5.2.4, we consider effects of NMFS's implementation of the sea turtle conservation regulations in the Southeast.

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 probably 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 (2005e), we estimated one smalltooth sawfish would be caught in a shrimp trawl annually in the South Atlantic EEZ. Similarly in NMFS (2006b), 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 during that time. 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. Via these mandatory programs, NMFS to date has documented 10 additional smalltooth sawfish captures in shrimp trawls, all in waters off Florida in the Atlantic and the Gulf. All captures have occurred in main nets of otter trawls; no interactions with try nets have been reported.

Two attempts have been made to estimate incidental captures[29] 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 observed captures through 2010. No smalltooth sawfish were observed captured in trawls in 2011 or 2012. In early January 2013, the SEFSC observed three smalltooth sawfish captures on one shrimp trawl fishing in the Gulf EEZ approximately 75 km (45 mi, or 40 nmi) NW of Key West or about about 3.5 KM (2.2 mi, or 2 nmi) north of the FKNMS. Total observed effort data and total fleet effort for 2013 are not available for extrapolation. Thus, NMFS-SEFSC (2011) still represents the best available data on which to base our capture estimates.

Summary and Our Application of NMFS SEFSC (2011) Data, Methods, Results and Discussion

[29] The reports use the more general term “take”, but the take discussed throughout the report is in the form of “capture, thus they describe the same effect.

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 zone 2 through statistical zones 24-26 in the U.S. South Atlantic Ocean (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). While smalltooth sawfish have occurred above 26°N 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 years combined (2008-2010). Sawfish captured in non-sampled tows (n=2) or before the program became mandatory (n=1) were excluded from further analysis. 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 5 sawfish (3 in the South Atlantic EEZ and 2 in the Gulf of Mexico EEZ) captured in 5,559 total tow hours sampled. 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 in statistical zones 1-4 than in the South Atlantic portion of statistical zone 2 through statistical zones 24-26. In the Gulf of Mexico area, shrimp effort averaged 116,515 hours towed while in the South Atlantic area 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) pointed out that 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 noted 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. NMFS SEFSC (2011) concluded that, 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 capture estimate for all areas for smalltooth sawfish is likely more valid for the shrimp fishery overall. Based on that conclusion, we believe an "all areas" capture estimate represents the best available estimate of smalltooth sawfish captures.

NMFS SEFSC (2011) modeled extrapolated incidental take estimates for smalltooth sawfish using annual (2008, 2009, and 2010) and a 3-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. Thus, we believe the 3-year average CPUE represents the best available CPUE for estimating sawfish captures.

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= 0.00068, SD 0.01044) multiplied by the total shrimp effort. Total effort for 2010 was not available for the South Atlantic and only preliminary results were available then 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 CPUE average) and were presented in NMFS SEFSC (2011). In the May 2012 opinion, we used the 2008 and 2009 combined effort for our capture estimate. However, in revisiting this determination during this consultation, we noted that effort in 2008 was considerably lower than in 2009 (i.e., 92,764.24 hours towed in 2008; 141,243.5 hours towed in 2009; average=117,003.8), thus using the 2008 and 2009 had lowered our estimate (ie., 79.8 captures based on 2008 and 2009 effort combined versus 96.33 captures based on 2009 effort only). Because we believe 2009 effort is representative of future effort as discussed in our effects analysis for sea turtles, we believe it is more appropriate, consistent, and conservative to base our capture estimate on the 2009 effort instead.

The annual take estimates calculated based on combined effort across areas (Gulf and South Atlantic) and 2009 effort was 96.33 sawfish captures annually (NMFS-SEFSC 2011). We therefore anticipate 288 smalltooth sawfish captures will occur every three years.

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 (2005d; 2006b), 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 cod end 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 was released in an unknown condition. Of the total 8 observed captures during the analysis time frame (i.e., through 2010), 2 were released dead, 4 were released alive, and 2 with uncertain fates. Table 42 includes the detailed information from these observed encounters.

Table 42. Detailed Information on Observed Sawfish Interactions through 2010 (Scott-Denton 2010).

Date	Depth (ft)	Detailed Observer Notes on Condition and Fate

June 7,2002	22	Caught net position 3; tore up net; released alive; swam away on surface.
June 26, 2008*	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.
March 5, 2009	184	Sawfish blocking TED, ~12 ft 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;
March 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.
March 9, 2009	183	Sawfish on net #3, tumbled out of net; released alive.
December 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.
February 19, 2010	130	~6.5 ft 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 ft total length; ~4-ft 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 smalltooth sawfish recovery plan (NMFS 2009d) 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 capture event record 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, sub-lethal effects.

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 ranges 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 through 2010 (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, they noted it "may have gone belly up." Thus we conservatively assumed it was also lethal. Therefore, the mortality rate for observed smalltooth sawfish captured in the federal shrimp fisheries through 2010 was 37.5% (3÷8). Of the three smalltooth sawfish observed captured in shrimp trawls in 2013, two were released alive and presumed to fully recover and one was dead. Adding these 3 records to the 8 records we already had would bring our estimated mortality rate to 36.4 (4÷11), thus would only change the rate by 1%. Applying this mortality rate to the triennial 288 captures, we estimate 105 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 shrimp otter trawls 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 smalltooth sawfish could free itself by swimming out of the 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's implementation of the sea turtle conservation regulations in the South Atlantic on Atlantic sturgeon. NMFS's 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 (2007b) 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%) of Atlantic sturgeon bycatch in otter trawls occurred at depths less than 20 meters, and about 90% 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 sub-adult 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 sub-adult Atlantic sturgeon (141 sub-adults 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 12). 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. No Atlantic sturgeon have been observed caught since 2011.

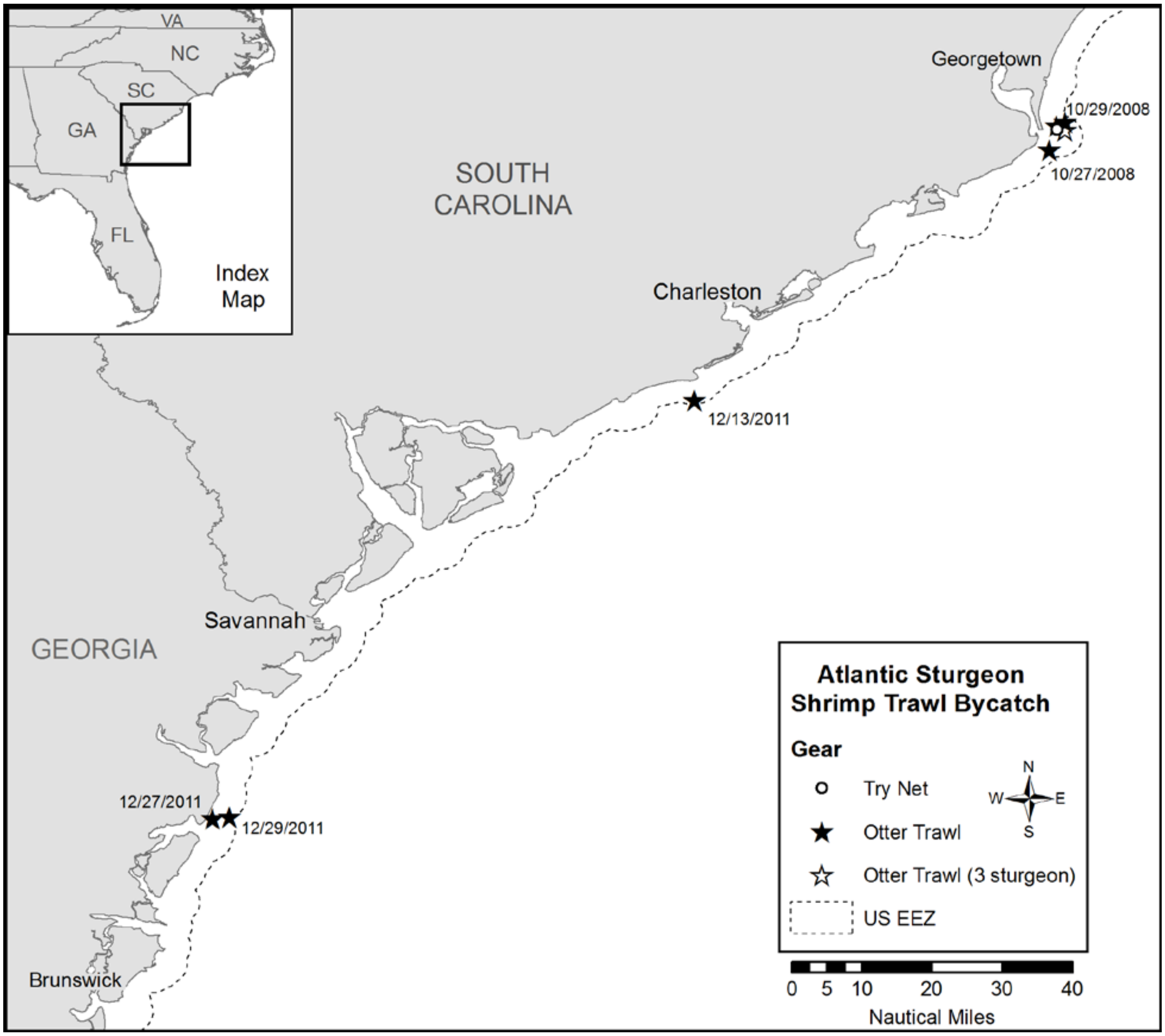

Figure 12. Locations and dates of captures in state waters of nine Atlantic sturgeon by three shrimp trawlers in the South Atlantic based on observer reports.

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 9 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%) 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 is likely that the catch rates of sturgeon are higher in state waters than federal waters. This is based on the species' apparent preference for coastal, shallower waters, and the actual observed catches—nine in state waters versus zero in federal waters, even with more sampling occurring in state waters than federal waters. We do know, however, 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. We estimate that about 39% 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 cod ends with a divider panel originating at the cod end 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 cod end, 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% 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% reduction by weight (i.e., 6 kg of Atlantic sturgeon were captured in the net with the TED versus 109.1 kg 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% 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% of the total interactions) interacted with the South Atlantic federal shrimp fishery based on the 2009 effort data, with 13% (74 Atlantic sturgeon) incidentally captured in shrimp nets and 87% (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 sea turtle release rates. TED violations may also lower the ability of Atlantic sturgeon to escape capture via TEDs. 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 passing through the bars of the TED and into the cod end. 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 TED violations on these species to also be different. We would expect sturgeon to be less impacted by at least certain violations due to their morphology (e.g., their narrow body size would likely allow them to navigate smaller openings than required), but we have no data to support quantifying such an effect on sturgeon. Based on documented TED violations since the opinion was completed, severe TED violations such as no TED or sewn shut TEDs have not been documented during TED boardings conducted over the past year and half and are believed to be extremely rare in the fleet. 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, and we make no further attempt to account for additional impacts resulting from lack of TED compliance.

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 1 sturgeon/650 days or 0.0015 Atlantic sturgeon per day. In 2009 effort was 13,464 days at sea for the year. We estimated 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% 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 0% 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%. 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% 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 generally pulled for short periods to determine the fishability and productivity 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. In January 2012 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% 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 (NEFOP) and the At Sea Monitoring (ASM) programs were used in the MSA to determine the percentage of fish from each of the DPSs at the selected locations along the coast.

Marine Mixing Zone 3, 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. The MSA was updated by the NMFS Northeast Region in February 2013. However, no new data for Marine Mixing Zone 3 were available, and NMFS determined that the original data from the NEFOP and ASM programs represent the best available information. According to the MSA, the composition of Atlantic sturgeon in Marine Mixing Zone 3 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 43 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% mortality rate calculated in Section 5.3.3.2. Note that the percentages will add up to more than 100% and the total of each category of interactions by DPS will be greater than the total number of interactions presented in the previous section due to the usage of the highest percentage calculated by the MSA for each DPS.

Table 43. 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%	52	45	7	1
NYB	26%	149	129	20	3
CB	18%	103	89	14	2
Carolina	29%	166	144	22	3
SA	79%	451	392	59	7

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 44). 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 44. 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, TED requirements in the shrimp otter 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% of encountered sturgeon from capture by trawl nets. Therefore, the mandatory use of TEDs in otter trawl shrimp fisheries likely significantly increases the survival of Atlantic sturgeon encountering shrimp otter trawls in state and federal waters from what it would be without the existing regulations Atlantic sturgeon may also benefit to lesser extent from alternative tow-time requirements as the amount of time an Atlantic sturgeon was trapped would be reduced, at least in cases when the sturgeon was caught early in the tow.

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 Gulf sturgeon. In Section 5.4.4, we consider effects of NMFS's implementation of the sea turtle conservation regulations in the Gulf of Mexico. NMFS's 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 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 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 November through February, when they are feeding in the northern Gulf 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 seafloor. 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 swim out of 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 deepwater 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 13). Both of these captures were in main trawl nets in relatively shallow waters.

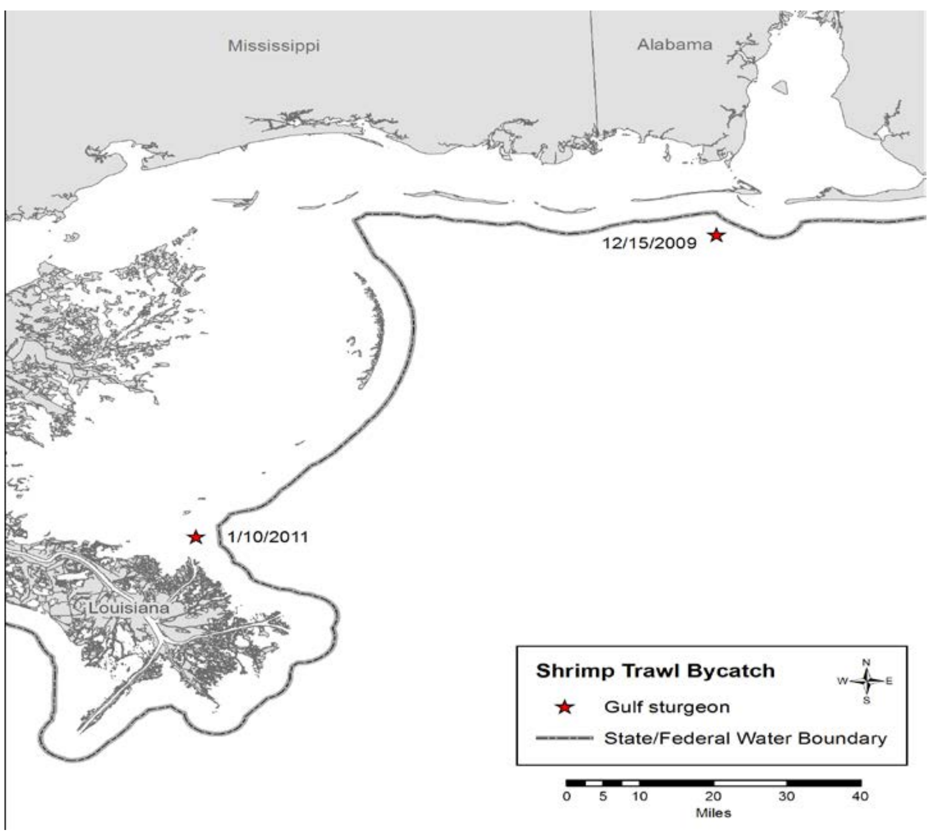

Figure 13. Location of observed Gulf sturgeon captures in shrimp trawls by date relative to state and federal fishing boundaries.

With only two Gulf sturgeon observed as captured in NMFS's Shrimp Observer Program, extrapolating to the entire Gulf of Mexico and estimating the number of Gulf sturgeon captured by the federal fishery, as was done for Atlantic sturgeon, would result in variances around the estimates and confidence intervals so large that it would render the point estimate meaningless. Application of the methods used for Atlantic sturgeon is particularly inappropriate because of differences in these species' distribution in the action area. Unlike for Atlantic sturgeon, Gulf sturgeon data support that Gulf sturgeon stay mainly within nearshore waters, and records documenting their presence in federal waters are extremely limited. In order for extrapolating a CPUE to be reasonable, the species would have to have a more uniform distribution.

Given the low level of observer coverage (~2% observer coverage since mandatory), assuming that the only captures in Gulf of Mexico shrimp fisheries in the past six years (July 2007 through March 2012) were observed is unreasonable, even though such captures are likely very rare. Based on the results of the Flexible Flatbar Flynet TED testing which documented 87% of Atlantic sturgeon escaping capture through the TED, NMFS reasonably assumes that for every Gulf sturgeon caught in a trawl, and additional 8 may escape via TEDs (1 capture/13%=7.7). With the limited available data, we conclude that observed captures will not exceed one per year based on the records to date, and that an additional 8 Gulf sturgeon may interact with shrimp trawls in federal waters, but escape through a TED and be undetected.

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 1992, of which 76 were captured in trawls, 10 in wing nets, and 91 in gillnets. LADWF noted an overall mortality rate of less than 1% (1995a). 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 0% mortality (e.g., Stein et al. 2004). Although recent Atlantic sturgeon observed captures in the Southeast shrimp fisheries documented 11% mortality, the actual number of Atlantic sturgeon this number was based on was a single fatality documented and both of the Gulf sturgeon observed captured in shrimp trawls were released alive. Based on the one Atlantic sturgeon mortality observed between 2008 and 2011, we anticipate one Gulf sturgeon mortality in federal waters once every 4 years.

5.4.4 Effects of the Sea Turtle Conservation Regulations

Based on the available information, TED requirements in shrimp otter trawl fisheries likely benefit Gulf sturgeon by providing a route of escape. Reports indicate both Gulf and Atlantic sturgeon can utilize TEDs to escape capture in trawl nets. Results of the Flexible Flatbar Flynet TED testing for Atlantic sturgeon indicated their bycatch was reduced by 87%. Therefore, the mandatory use of TEDs in Gulf of Mexico shrimp otter trawl fisheries 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 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). In making this conclusion for each species, we first look at whether there will be a reduction in the reproduction, numbers, or distribution. Then, if there is a reduction in one or more of these elements, we evaluate whether it will cause an appreciable reduction in the likelihood of both the survival and the recovery of the species.

The NMFS and USFWS's 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, smalltooth sawfish, and Atlantic 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 non-lethal 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 nets(butterfly trawls) and try nets) we produced a combined estimate of 81,358 interactions with loggerhead sea turtles annually of which 7,778 were estimated to die. However, as explained in Section 5.1.6, these estimates are all 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. We also made many new assumptions to try and account for the effects that TED violations have on trawl sea turtle capture rates. As noted earlier, while our capture rate analysis based on boarding data was certainly reasonable, it was based on little empirical data and conservative assumptions, thus was also highly uncertain. 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 to female ratio (NMFS-SEFSC 2009b).

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.

SEFSC (2009) estimates the adult female population size for the NW Atlantic DPS is likely between approximately 20,000 to 40,000 individuals, with a low likelihood of being up to 70,000 individuals. A more recent conservative estimate for the entire western North Atlantic population was a mean of 38,334 adult females using data from 2001-2010 (Richards et al. In Review). 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. Further insight into the numbers of loggerhead sea turtles along the U.S. coast is available in NEFSC (2011), which reported a conservative estimate of 588,000 juvenile and adult loggerhead sea turtles present on the continental shelf from the mouth of the Gulf of St.

Lawrence to Cape Canaveral, Florida, when using only positively identified loggerhead sightings from an aerial survey. A less conservative analysis from the same study resulted in an estimate of 801,000 loggerheads in the same geographical area when a proportion of the unidentified hardshell turtles were categorized as loggerheads. This study did not include Florida's east coast south of Cape Canaveral or the Gulf of Mexico, which are areas where large numbers of loggerheads are also expected.

A detailed analysis of Florida's long-term loggerhead nesting data (1989-2012) revealed three distinct annual trends. Following a 23% increase between 1989 and 1998, nest counts declined sharply over nearly a decade. However, annual nest counts show a strong increase over the last five years. Examining only the period between the high-count nesting season in 1998 and the most recent (2012) nesting season, researchers found no demonstrable trend, indicating a reversal of the post-1998 decline. The overall change in counts from 1989 to 2012 is positive. Nest counts in 2012, corrected for subtle variation in survey effort, were slightly below the high nest count recorded in 1998. Florida accounts for more than 90% of U.S. loggerhead nesting (Florida Fish and Wildlife Conservation Commission (FWC) data, http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/).

The increasing trends on Florida core nesting beaches includes the most recent nesting season (2012), which had 58,172 loggerhead nests counted – the second highest count in 24 years. Index beaches in the Florida Panhandle, which are not part of the set of core beaches, also had high loggerhead nest counts in 2012. Following a general decline in counts since 1997 when surveys of Panhandle index beaches began, the 2012 season had the highest number recorded in 16 years of nest counts.

Southeast shrimp fisheries have been taking large numbers of loggerheads sea turtles for decades. Our 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% compliance assumption) and incorporation of additional gear types (i.e., skimmer trawls and try nets). However, some inferences about anticipated effects relative to past effects can be made by recognizing those differences. First, our 2002 estimates were unrealistically low because they assumed 100% 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 recent levels.

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 are expected to have created at least a temporary change in the environmental baseline for the action area.

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.

We believe that the incidental take and resulting mortality of loggerhead sea turtles associated with the proposed action are not reasonably expected to cause an appreciable reduction in the likelihood of survival of the NWA DPS of loggerhead sea turtles. We believe the current population is large (i.e., several hundred thousand individuals) and is showing encouraging signs of stabilizing and possibly increasing. Over at least the next several decades, we expect the western North Atlantic population to remain large (i.e., hundreds of thousands of individuals) and to retain the potential for recovery, and that the proposed 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.

The Services' recovery plan for the Northwest Atlantic population of the loggerhead turtle (NMFS and USFWS 2008a) 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 try nets in the domestic commercial shrimp fishery.
- 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.

Recovery is the process of removing threats so self-sustaining populations persist in the wild. The sea turtle conservation regulations support or implement the Service's recovery plan developed for the NWA loggerhead DPS (NMFS and USFWS 2008a). 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. However, we believe that 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. Both the Peninsular Florida Recovery Unit, the largest loggerhead nesting assemblage in the Northwest Atlantic, and the Northern Florida Recovery Units are showing encouraging signs of increasing.

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. Therefore, 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 recovery of the NWA loggerhead DPS, even in light of the impacts of the DWH oil release event.

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. The remaining impacts from the proposed action will not appreciably affect the population's persistence into the future or its potential for recovery.

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] nets and try nets) we produced a combined estimate of 13,910 interactions annually of which 1,543 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% 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 in the overall population. Since the abundance trend information for green sea turtles is clearly increasing, in spite of the fact that the shrimp fishery has been operating and adversely affecting the population for decades, 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 nests; 2004 – 3,577 nests; 2005 – 9,644 nests; 2006 – 4,970 nests. The average is 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 nests; 2008 – 6,385 nests; 2009 – 3, 000 nests; 2010 – 8,426 nests; 2011 – 10,701 nests), 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 (i.e., growing 4.9% annually).

The recovery plan includes three 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 supports 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. 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.

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 green sea turtles 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 hawksbill 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 by the Deepwater Horizon oil event, 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. There are currently no reliable estimates of population abundance and trends for non-nesting hawksbills at the time of this consultation; therefore, nesting beach data is currently the primary information source for evaluating trends in abundance. Mortimer and Donnelly (2008) found that nesting populations in the Atlantic (especially in the Insular Caribbean and Western Caribbean Mainland), 9 of the 10 sites with recent data (within past 20 years), showed recent nesting increases were located in the Caribbean. These increases have been observed in spite of the fact that the shrimp fishery has been operating and adversely affecting the population for decades. Since the number of interactions is expected to be no greater than has occurred in recent years, and much lower than had been occurring in past decades, 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, sub-adults, 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% 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 (Puerto Rico), and Buck Island Reef National Monument (USVI), 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 the case 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.

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 Hawksbill sea turtles 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] nets and try nets), we produced a combined estimate of 430,787 Kemp's ridley sea turtle interactions annually of which 44,257 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 because their benthic foraging habitat overlaps with the shrimp fishery.

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.

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% per year and that the population could attain at least 10,000 females nesting on Mexico beaches by 2015. NMFS et al. (2011b) contains an updated model which predicts that the population is expected to increase 19% 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. (2011b) model prediction. A subsequent increase to 20,570 nests in 2011 occurred and then a record high of 21,797 occurred in 2012, but in 2013 there was a second significant decline, with only 16,385 nests recorded (Gladys Porter Zoo nesting database 2013. We will not know if the population is continuing the general trajectory predicted by the model until future nesting data are 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 2000a). 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 United States under the sea turtle conservation regulations and in Mexican waters as required by their federal regulations 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% compared to pre-TED levels.

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 2011-2013 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 relative to the past decade, even in light of the adverse impacts expected to have occurred from the DWH oil spill and the strandings documented in 2011-2013. The proposed action is expected to further reduce the effects of Southeast 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. 2011b) 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 (2011b) 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 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 the 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 State 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, to a record high of 209 nests in 2012 (National Park Service data http://www.nps.gov/pais/naturescience/strp.htm, http://www.nps.gov/pais/naturescience/current-season.htm).

The estimated number of interactions provided in Section 5 is highly uncertain and is unlikely to accurately represent actual interactions occurring in shrimp trawls in the Southeast. 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 numbers 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.

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 Kemp's ridley sea turtles in the wild.

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 1,427 leatherback interactions annually of which 144 were estimated to die. However, as explained in Section 5.6, 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. We also made many new assumptions to try and account for the effects that TED violations have on trawl sea turtle capture rates. As noted earlier, while our capture rate analysis based on boarding data was certainly reasonable, it was based on little empirical data and conservative assumptions, thus was also 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 of 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%) 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 (i.e., 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 1992a) 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% 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% 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 past decades. 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.

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 leatherback sea turtles in the wild.

7.6 Smalltooth Sawfish

The loss of up to 105 smalltooth sawfish from the proposed action every three years would represent a reduction in numbers. These lethal interactions would also result in a reduction in future reproduction, presuming some of the individuals taken would be female and would have survived other threats and reproduced in the future. An adult female smalltooth sawfish may have a litter of approximately 10 pups probably every two years, and because smalltooth sawfish produce more well-developed young, it is likely that some portion of these pups would have survived. Thus, the death of any females eliminates any individual's contribution to future generations, and the proposed action would result in a reduction in future smalltooth sawfish reproduction. A reduction in the distribution of the smalltooth sawfish is not expected as the anticipated lethal interactions are expected to be dispersed throughout the range of smalltooth sawfish that overlaps with the proposed action (i.e. mainly off Florida and the Florida Keys).

Although lethal take of 105 smalltooth sawfish every three years will result in an instantaneous reduction in absolute population numbers, we believe these mortalities associated with the proposed action are not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of the U.S. DPS population of smalltooth sawfish in the wild. This is because we do not believe these mortalities will have any measurable effect on these trends. The taking of 105 sub-adult/adult animals is significant for a population that is currently estimated to be at a level less than 5% of its size at the time of the European settlement. However, available data summarized in Section 3 indicates the smalltooth sawfish population is stable or increasing (Carlson and Osborne 2012a). 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 105 sub-adult/adult males or females over a 3-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 2012a).

Whether the reduction in numbers and reproduction of smalltooth sawfish attributed to the proposed action 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. 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 lethal taking of 105 sub-adult/adult animals is significant for a population that is currently estimated to be 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 2012a). 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 105 sub-adult/adult males or females over a 3-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 2012a).

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 2009d) 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.

Conclusion
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 effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of both the survival and recovery of US DPS of smalltooth sawfish in the wild.

7.7 Atlantic sturgeon

Our jeopardy focuses on the federal fishery because that’s the only place where adverse effect from the proposed action area expected. Effects from the sea turtle conservation regulations are expected to be solely beneficial.

The expected lethal capture of up to nine Atlantic sturgeon by the South Atlantic shrimp fishery in federal waters, with one to seven lethal captures of Atlantic sturgeon originating from each of the five DPSs, would result in a reduction in numbers within each DPS. These lethal interactions would also result in a reduction in their future reproduction, if some of the individuals taken would be female and would have survived other threats and reproduced in the future. With that exception, 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. Changes in the distribution of Atlantic sturgeon are also not 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.

We do not believe the reductions in numbers resulting from the proposed action are likely to reduce the population's ability to persist into the future. 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. No mortality is anticipated in try nets. The loss of such small numbers of individuals will not significantly decrease the overall populations of the DPSs. 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.

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 any Atlantic sturgeon DPS' survival or recovery in the wild.

7.8 Gulf Sturgeon

Our jeopardy focuses on the federal fishery because that is the only place where adverse effect from the proposed action area expected. Effects from the sea turtle conservation regulations are expected to be solely beneficial.

In Section 5, with the limited available data, we concluded that observed captures in federally authorized shrimp trawls will not exceed one per year, and that an additional 8 Gulf sturgeon may interact with shrimp trawls, but escape through a TED and be undetected. 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 vast 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 vast majority of the Gulf sturgeon captured by federal shrimp trawls are also expected to be released alive (i.e. we concluded a mortality may be documented every four years.

Although the loss of any adult Gulf sturgeon will reduce number and potential reproductive output, the reduction is not likely to appreciably reduce the likelihood of survival for Gulf sturgeon. The 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 action will not affect Gulf sturgeon in a way that prevents the species from having a sufficient population, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Gulf sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter (i.e., it will not increase the risk of extinction faced by this species). The loss of only small numbers of individuals will not significantly decrease the overall population of Gulf sturgeon or reduce its distribution. Additionally, the proposed action will not create any barrier to pre-spawning sturgeon accessing the overwintering sites or impede

Gulf sturgeon from accessing any seasonal concentration areas, including foraging, spawning or overwintering grounds in the Gulf of Mexico.

Recovery is defined as the improvement in status such that listing is no longer appropriate. The Gulf Sturgeon Recovery/Management Plan was created in 1995 (USFWS 1995). During the most recent 5-year review (NMFS 2009), it was determined that the 1995 criteria do not directly address the five statutory listing/recovery factors. Five-factor-based criteria are necessary for measuring progress towards reducing threats and for determining when the protections of the Act are no longer necessary for the taxon. New criteria in a revised recovery plan should use demographic parameters that can be estimated from mark-recapture studies, including population abundance, and other appropriate metrics organized according to the statutory five factors. To evaluate whether the reductions in numbers and reproduction from the proposed action will appreciably reduce the Gulf sturgeons likelihood of recovery in the wild, we evaluated whether these reductions would in turn reduce the likelihood that the status of the Gulf sturgeon can improve to the point where it is recovered and could be delisted.

The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in only a small reduction in the number of Gulf sturgeon in the Gulf of Mexico and therefore, it will not affect the overall distribution of Gulf sturgeon. The reduction in numbers and future reproduction is very small, therefore will not change the status of the species. The effects of the proposed action will not delay the recovery timeline or otherwise decrease the likelihood of recovery since the action will cause the mortality of a small percentage of the species as a whole and this mortality is not expected to result in the reduction of overall reproductive fitness for the species as a whole. We therefore conclude that the proposed action is not expected to appreciably reduce the likelihood of the Gulf sturgeon's recovery in the Gulf of Mexico.

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 Gulf sturgeon survival or recovery in the wild.

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's 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 an ESA Section 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 of this opinion 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 unobserved by persons at the surface. 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 haulback of the gear. This event is more likely to occur with high-angle TEDs (>55 degrees from the horizontal) than other types of violations because sea turtles can become impinged on deflector bars due to water pressure/flow 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 cod end 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, since 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 U.S. Southeast 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 to monitor 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 ensure 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 subsequently 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 2009 effort levels 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[30]]) as our baseline. Similarly, future compliance levels are expected to result in TEDs being 88% 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 Section 2.1.1 and the RPMs and their implementing terms and conditions. At the end of each year, both the effort and compliance data must be analyzed 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 whether it must reinitiate consultation, and whether rule making to address the activities leading to the greater effects is warranted.

Unlike the case 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. For sturgeon, this is because 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 haulback 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 3-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

[30] 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).

on our experience monitoring fisheries, we believe a 3-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 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 [31]	1710 total interactions, including 222 captures of which 27 are expected to be lethal every three years[*], with DPS limits as follows: • Gulf of Maine DPS ≤ 156 interactions, including 21 captures, of which 3 are expected to be lethal • New York Bight DPS ≤ 447 interactions, including 60 captures, of which 9 are expected to be lethal • Chesapeake Bay DPS ≤ 309 interactions, including 42 captures, of which 6 are expected to be lethal • Carolina DPS ≤ 498 interactions, including 66 captures, of which 9 are expected to be lethal • South Atlantic DPS ≤ 1353 interactions, including 177 captures, of which 21 are expected to be lethal	63total 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 ≤ 6 interactions all resulting in captures, of which none are expected to be lethal • New York Bight DPS ≤ 18 capture, of which none are expected to be lethal • Chesapeake Bay DPS ≤ 12 interactions, all resulting in capture, of which none are expected to be lethal • Carolina DPS ≤ 21 interactions all resulting in capture, of which none are expected to be lethal • South Atlantic DPS ≤ 51 interactions all which resulting in capture, of which none are expected to be lethal	1773 total interactions, including 285 captures of which 27 are expected to be lethal every three years[*], with DPS limits as follows: • Gulf of Maine DPS ≤ 162 interactions, including 27 captures, of which 3 are expected to be lethal • New York Bight DPS ≤ 465 interactions, including 66 captures, of which 9 are expected to be lethal • Chesapeake Bay DPS ≤ 312 interactions, including 54 captures, of which 6 are expected to be lethal • Carolina DPS ≤ 519 interactions, including 87 captures, of which 9 are expected to be lethal • South Atlantic DPS ≤ 1404 interactions, including 228 captures, of which 21 are expected to be lethal
Smalltooth Sawfish	288 (105) every three years	--	288 (105) every three years

*Incidental take will be monitored based on the 3-year running totals (e.g., 2012-2014, 2013-2015)
**All try net interactions result in captures

[31] Note that the total of each category of interactions by DPS will be greater than the total number of interactions due to the usage of the highest percentage calculated by the MSA for each DPS.

9.2 Effect of the Take

NMFS has determined that 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).[32]

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 shrimp fisheries and continue to work to better determine the effects these fisheries have on sea turtles.

2) NMFS must monitor compliance with TED regulations and must ensure compliance with TED regulations is at or below the anticipated levels in the ITS of this opinion.

3) NMFS must continue outreach programs to train fishermen and net shop personnel in the proper installation and use of TEDs.

4) NMFS must continue to work with industry on TED development and to conduct research to better understand the nature of sea turtle interactions, particularly very small juvenile sea turtle interactions, with shrimp trawls in inshore and nearshore waters.

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 Southwest and South Florida fishers 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.

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[32] NMFS has also determined that the proposed action is not likely to jeopardize Gulf sturgeon, but because NMFS has 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.

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 described above and outline required reporting and monitoring requirements. These terms and conditions are non-discretionary.

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 effort trends in U.S. Southeast 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), 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 collect logbook data in the South Atlantic comparable to the logbook data collected in the Gulf or work with the states to collect these data.

3) NMFS must advance sea turtle population estimates beyond a nesting 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 shrimp 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 a year and half of the date of this opinion.

4) Observers should gather scientific information on any incidental takes of sea turtles that are observed to gain as much knowledge from and about sea turtle interactions with shrimp fisheries as possible. This opinion serves as the permitting authority for taking associated with handling, identifying, measuring, weighing, photographing, flipper tagging, passive integrated transponder (PIT) tagging, skin biopsying, and releasing any incidental sea turtle takes (without the need for an ESA Section 10 permit). Samples collected must be analyzed to determine the genetic identity of individual sea turtles takes.

5) NMFS must increase the amount of empirical and other data it has on trawl sea turtle capture probabilities associated with TED violations that are documented by observers, GMT, and OLE capture probabilities. These additional data must be used to test and revise as needed the violation and capture rate matrix used in this opinion (i.e., Table 15 of Section 5.1.3.2).

6) Because observers are unable to detect the majority of sea turtle interactions in shrimp trawl fisheries that use TEDs, NMFS must investigate alternative methods that can be used to detect sea turtle interactions in shrimp trawls with TEDs.

7) NMFS must explore requiring new technologies in Southeast shrimp fisheries (e.g., vessel monitoring systems) to better understand the potential interaction and relationship, if any, of fishery effort and seasonal and/or periodic sea turtle stranding events. NMFS must produce a report outlining potential options and their feasibility within one year of the date of this opinion.

8) NMFS must conduct an analysis of sea turtle stranding data to document whether the size of sea turtles that strand has changed since implementation of the 2003 larger TED requirement. This analysis must be completed within two years of the date of this opinion.

The following terms and conditions implement RPM No. 2.

9) NMFS must continue to require its observers to be trained during initial or refresher observer training sessions by NMFS gear specialists in identifying and inspecting TEDs and in recording such information for any trip observed.

10) NMFS must continue to monitor compliance with TED regulations using one or more of four following elements: SEFSC GMT, NMFS OLE, observer data, and other partner agencies.
    a) The SEFSC GMT must continually monitor shrimp fishing vessels dockside and at sea throughout the Gulf and South Atlantic areas. The SEFSC GMT personnel must record all monitoring efforts using standardized boarding forms.
    b) NMFS OLE must continue to enforce TED regulations and must keep records of all of its TED compliance boardings using standardized boarding forms.
    c) NMFS must work with state enforcement agencies and the USCG to improve and standardize enforcement of TED regulations, such as promoting the use of standardized boarding forms.

11) NMFS SERO PRD must establish a centralized TED compliance evaluation database to allow SEFSC GMT, NMFS OLE, and other partner agencies to remotely enter data from standardized TED inspection boarding forms within one year of the date of this opinion.

12) NMFS SERO PRD must coordinate with the SEFSC GMT, the SEFSC observer program, NMFS OLE, USCG, and state enforcement agencies to gather and insure that quality and timely monitoring of information on compliance with TED regulations in the shrimp fisheries is provided to NMFS SERO PRD and is entered into the TED compliance evaluation database.

13) NMFS must use data on TED compliance to target outreach, enforcement effort, and emergency rules, if warranted, ranging from possible TED modifications to closures of areas to shrimp fishing.

14) NMFS must develop a policy specifying data requirements or minimum data standards for taking various actions (e.g. time area closures) to address non-compliance. Our goal is to

use observer data for compliance analyses because the program is based on representative sample and avoids potential biases from using enforcement data. However, until that time we must to rely on OLE and GMT data and increased enforcement. As part of this policy, NMFS must develop a general policy or guidelines outlining methods and standards for determining if a documented lack of compliance is throughout the entire Gulf area or Atlantic area) or concentrated in certain portions of an area. This policy must be finalized within one year of completing the opinion and be updated as necessary.

15) 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 implements RPM No. 3.

16) NMFS must continue funding the SEFSC GMT to conduct outreach and training of TED installation and use.

17) NMFS must continue training Southeast fishermen and net shop owners on the proper installation and use of TEDs.

18) The SEFSC GMT must report to SERO monthly on its TED training and outreach activities.

19) NMFS must form a working group including SEFSC GMT, OLE, and SERO staff to develop procedural guidelines for improving coordination during unusual sea turtle stranding and enforcement events and to improve data and reporting quality of such events.

The following terms and conditions implements RPM No. 4.

20) 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 under 50 CFR § 223.207(e)(2) to industry to test industry-developed TEDs.

21) NMFS must conduct research to evaluate TED designs for use in the skimmer and wing net trawl fisheries, as well as inshore otter trawl fisheries, which effectively reduce bycatch of juvenile sea turtles.

The following terms and conditions implements RPM No. 5.

22) NMFS must complete a pilot study to test video monitoring hardware and software to determine the feasibility of developing a cost-effective and reliable system for monitoring smalltooth sawfish bycatch, release mortality, and other shipboard practices aboard shrimp trawl vessels in the southwest Florida area adjacent to the Florida Keys.

23) NMFS must require its observers to follow standard protocols for collecting smalltooth sawfish data onboard shrimp trawl vessels as outlined by the NOAA Fisheries-Galveston, Texas, Laboratory.
   a) Observers must be trained to tag smalltooth sawfish captured in shrimp trawls
   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. All smalltooth sawfish captured in shrimp trawls should be tagged to the extent feasible. Biological samples should also be collected as feasible consistent with sampling protocols developed by the Sawfish Implementation Team. The condition of each sawfish must be identified as one the following and photo-documented: (1) Sawfish completely wrapped or significantly wrapped in the shrimp trawl, appears moribund and unresponsive on deck, (2) Sawfish completely wrapped or significantly wrapped in the shrimp trawl, is responsive on deck with spiracles exhibiting movement, (3) Sawfish is partially wrapped in shrimp trawl, is responsive on deck with spiracles exhibiting movement, or (4) Sawfish is partially wrapped in the shrimp trawl and is very responsive on deck.
   c) Retrieved dead smalltooth sawfish must not be returned to the water. All dead carcasses of smalltooth sawfish must be placed on ice and transferred to the SEFSC (Dr. John Carlson).

24) NMFS must use available observer data and any other appropriate data sources to update the 3-year take average as new data becomes available.

25) NMFS must evaluate post-release mortality rates for smalltooth sawfish in the shrimp fishery via classifying sawfish conditions and by tagging animals alive on deck with a pop-up archival transmitting (PAT) tag as described in Carlson et al. (in review) prior to release, as feasible, and via modeling the probability of survival after release using survival analysis following Therneau and Grambsch (2000).

26) 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.

27) 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 (T&Cs) implement RPM No. 7.

28) NMFS must observe shrimp trawls in North Carolina, South Carolina, and Georgia, where Atlantic sturgeon interactions are most likely to occur, for a total of at least 140 sea days annually. If more than 1 sturgeon is observed caught during any year, NMFS will increase the number of sea days observed by 5% the following year. 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.
   b) When possible:
      i) any Atlantic sturgeon caught in a shrimp trawl must be tagged, tissue sampled, and scanned for PIT tags.
      ii) for each observed 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) shall be recorded prior to its release.
      iii) Tissue samples must 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 Ms. 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.

29) Any sturgeon captured with a PAT tag evaluated for post–release mortality.

30) All dead observed Atlantic sturgeon must be reported to Ms. Kelly Shotts (Kelly.Shotts@noaa.gov or (727) 551-5603). After activities described in T&C No. 28 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.

31) Flatbar Flynet TED testing documented an 87% reduction in Atlantic sturgeon captures by number, but a 95% reduction of Atlantic sturgeon by weight (i.e., 6 kg of Atlantic sturgeon were captured in the net with the TED versus 109.1 kg of Atlantic sturgeon in the control net), suggesting that the Gulf sturgeon that do not exit the net through the TED are smaller individuals. NMFS must monitor for any new information indicating that more small Atlantic sturgeon are or may be encountered by shrimp trawls.

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 cod ends 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 cod end 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% of encountered turtles from entering the trawls, but shrimp losses (15 to 30%) 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% 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% 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%.

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's 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's 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 non-compliance, 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% 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's 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 try net 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 cod end 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%, 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% (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 cod end 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% 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: Summary of TED Education, Training, and Outreach Conducted by NMFS Since May 2012

YEAR	MONTH	Lead	LOCATION	PURPOSE	No. of Events	Participating groups
2012	April	SEFSC	AL	TED Enforcement Training	3	AL DMR
2012	April	SEFSC	MS	TED Enforcement Training	1	MS DMR
2012	May	TX Sea Grant	Palacios, TX	Courtesy TED Inspections & Net Shop visits	multiple	TP&W
2012	May	SEFSC	LA	LADWF TEDs training	1	LADWF Law Enforcement & NOAA OLE
2012	May	SEFSC	GA	TED Compliance Inspections	1	GA DNR
2012	June	SEFSC	Galveston, TX	TED compliance presentation to Texas Shrimp Assoc.		TX Shrimp Assoc.
2012	June	SERO	LA	Public hearings on proposed skimmer TED rule	1	Local fishers
2012	July	NOAA OLE	W. LA & upper TX coast	TED compliance inspections	multiple	GMT , TP&W
2012	Aug	NOAA OLE	NC	TED compliance inspections	multiple	GMT, USCG
2012	Sept	NOAA OLE	SC & GA	TED compliance inspections	multiple	GMT
2012	Sept	SEFSC	MS & AL	Survey of TED bar spacing measurements	multiple	N/A
2012	Sept	OLE	Florida east coast	TED compliance inspections	multiple	GMT
2012	October	SEFSC	W. MS & Eastern LA	Outreach to fishers re: storm debris and TEDs	3	local fishers
2012	October	SEFSC	MS	Meeting with Vietnamese fishers association	1	fishing association
2012	October	SEFSC	NE Florida	Net shop visits / TED compliance	4	local net shop owners
2012	October	SEFSC	AL	Net shop visit	1	local net shop owner
2012	October	SEFSC	MS	High school TEDs outreach event	1	middle and high school students

2012	October	SEFSC	AL	Meeting with local fishers and boat owners re: TED compliance	1	local fishers and vessel owners
2012	Nov	SEFSC	MS	Meeting with Gulf and S. Atlantic Fisheries Foundation re: improving TED compliance	1	Fisheries Association
2013	Jan	SEFSC	MS	Meeting to develop standardized TED boarding form	1	SEFSC GMT
2013	Feb	SEFSC	MS	Final production of "Summary of Basic TED Requirements" a laminated guidebook for fishers	1	SEFSC GMT
2013	Feb	SEFSC	NC, SC, GA & NE FL	Courtesy TED inspections	multiple	SEFSC GMT
2013	March	SEFSC	AL & MS	Survey of trawling effort	2	SEFSC GMT
2013	March	OLE	LA	Dockside courtesy inspections and net shop visits	30	GMT & OLE
2013	March	LA Sea Grant	LA	"Dock Day" event for local fishers, Delcambre & Venice, LA	1	GMT, OLE & USCG
2013	April	SEFSC	LA	Courtesy TED inspections and fisher outreach	multiple	LA Sea Grant
2013	April	SEFSC	MS	Trawling effort survey in MS sound	2	SEFSC GMT
2013	April	SEFSC	MS	TEDs Enforcement training for NOAA OLE agents and officers	1	NOAA OLE
2013	April	SEFSC	LA	Courtesy TED inspections and fisher outreach	multiple	local fishers association
2013	May	SEFSC	TX	TED inspection training for NOAA shrimp fishery observers	1	NMFS Galveston staff
2013	May	Hancock County, MS Chamber of Commerce	MS	TEDs workshops for local fishers	3	MS fishers

2013	May	SEFSC	TX	TEDs inspection training for TP&W officers	2	TP&W
2013	May	SEFSC	MS	Trawling effort surveys in MS Sound	multiple	SEFSC GMT
2013	June	SEFSC	MS	courtesy at-sea TED inspections in MS Sound	11	SEFSC GMT
2013	June	SEFSC	MS	Meeting with MS DMR officers to discuss standardization of TED inspection	1	MS DMR
2013	July	SEFSC	TX	TED compliance inspection in association with Texas shrimp opening	multiple	TP&W & Texas Sea Grant
2013	July	SEFSC	NC	TED compliance inspections in Pamlico Sound	16	NOAA OLE
2013	Aug	NOAA OLE	NC	TED compliance inspections in Pamlico Sound	20	SEFSC GMT, USCG & NCDMF
2013	Aug	SC DNR	SC	TED compliance inspections in SC	multiple	SEFSC GMT
2013	Sept	SC DNR	SC	TED compliance inspections in SC	9	SEEFSC GMT
2013	Sept	GA DNR	GA	TED compliance inspections in GA	multiple	SEEFSC GMT
2013	Sept	SEFSC	MS & AL	TED compliance inspections in MS & AL	6	SEEFSC GMT
2013	Oct	SEFSC	MS & LA	Hurricane debris survey	1	SEEFSC GMT
2013	Dec	SEFSC	TX	TEDs training for NOAA Fisheries shrimp fishery observers	1	NMFS Galveston staff
2013	Dec	NFWIF	FL	Workshop on TEDs Enforcement	1	NOAA OLE, SEFSC GMT, USCG and State marine enforcement offices
2014	Feb	SEFSC	AL	Courtesy TED inspections and net shop visits	multiple	local fishers
2014	March	SEFSC	LA	Courtesy TED inspections and net shop visits	multiple	local fishers & net shops, local fishing associations
2014	March	LA Sea Grant	LA	"Dock Day" event for local fishers, Delcambre & Venice, LA	1	GMT, OLE & USCG

Appendix 4: Excerpt from Section 5.1.3.2 of 2012 Shrimp Opinion

- 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% compliance with the TED regulations and that only 3% of sea turtle interactions would result in capture (TEDs being 97% effective at releasing sea turtles) consistent with Epperly et al. (2002a). 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's 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 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%. Observed compliance estimates rose to approximately 62% in June, and 68% 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% probability of capture) relative to turtle size. For example, a TED angle of 65 degrees was scored as having a 90% probability of capturing a juvenile turtle and a 60% 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% probability of capturing an adult turtle but only a 10% probability of capturing a juvenile (Excel attachment to February 18, 2012 email from John Mitchell, NMFS SEFSC, to Jennifer Lee, NMFS SERO). A 3% 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)		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	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% in May, but then dropped by approximately 30% by June for both size classes and then another 10% for large sea turtles and 17% for small sea turtles by July. In August, compliance peaked and capture rates were approximately 6%. While captures rates did increase some during September through November, between August through November, the fleet still maintained capture rates below 12%.

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% 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% 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.

Appendix 5: 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

Fishery	ITS Authorization Period	Listed Species					
		Loggerhead	**Leatherback**	**Kemp's Ridley**	**Green**	**Hawksbill**	**Smalltooth Sawfish**
Coastal Migratory Pelagics	3-Year	33-All lethal	2 lethal takes for Leatherbacks, Hawksbill, and Kemp's Ridley-both lethal take		14-All Lethal	See leatherback entry	2 Non-lethal Takes
Dolphin-Wahoo	1-Year	12-No more than 2 lethal	12-No more than 1 lethal	3 for all species in combination-no more than 1 lethal take			None
Gulf of Mexico Reef Fish	3-Year	1,044-No more than 572 lethal	11-All lethal	108-No more than 41 lethal	116-No more than 75 lethal	9-No more than 8 lethal	8 Non-lethal Takes
HMS-Pelagic Longline	3-Year	1,905-No more than 339 lethal	1,764-No more than 252 lethal	105-No more than 18 lethal for these species in combination			None
HMS-Shark	3-Year	126-No more than 78 lethal	18-No more than 9 lethal	36-No more than 21 lethal	57-No more than 33 lethal	18-No more than 9 lethal	32–No more than 7 lethal take
Gulf of Mexico and South Atlantic Spiny Lobster	3-Year	3-Lethal or Non-Lethal Take	1 –Lethal or Non-Lethal take for Leatherbacks, Hawksbill, and Kemp's Ridley		3-Lethal or Non-Lethal Take	1 –Lethal or Non-Lethal take for Leatherbacks, Hawksbill, and Kemp's Ridley	2 Non-lethal Takes
South Atlantic Snapper-Grouper	3-Year	202-No more than 67 lethal	25-No more than 15 lethal	19-No more than 8 lethal	39-No more than 14 lethal	4-No more than 1 lethal	8 Non-lethal Takes

Appendix 6: 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.