Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency: National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Southeast Regional Office (SERO), Sustainable Fisheries Division (F/SER2)

Activity: The Continued Authorization of Fishing under the Fishery Management Plan for the Stone Crab Fishery of the Gulf of Mexico (F/SER/2005/07541)

Consulting Agency: NOAA, NMFS, SERO, Protected Resources Division (F/SER3)

Approved by: ______________________
Roy E. Crabtree, Ph.D., Regional Administrator

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Introduction

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 et seq.), requires each federal agency to ensure any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of any critical habitat of such species. When the action of a federal agency may affect an ESA-listed species or its critical habitat, that agency is required to consult with either NMFS or the U.S. Fish and Wildlife Service (USFWS), depending upon the protected species that may be affected.

Consultations on most listed marine species and their critical habitat are conducted between the action agency and NMFS. These consultations are concluded after NMFS has determined that an action is not likely to adversely affect listed species or designated critical habitat, or issues a biological opinion (opinion) identifying whether the proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify any critical habitat. If jeopardy or destruction or adverse modification is found to be likely, NMFS must identify reasonable and prudent alternatives to the action, if any, that would avoid jeopardizing any listed species and avoid destruction or adverse modification of any designated critical habitat. The opinion establishes an incidental take statement (ITS) specifying the amount or extent of incidental take of the listed species that may occur, reasonable and prudent measures (RPMs) to reduce the effect of take, and may recommend conservation measures to further conserve the species. Notably, no incidental destruction or adverse modification of critical habitat can be authorized. Thus, there are no RPMs for critical habitat, only reasonable and prudent alternatives that must avoid destruction and adverse modification.

This document constitutes NMFS' opinion on the effects of the continued authorization of stone crab fishing in the U.S. South Atlantic and Gulf of Mexico Exclusive Economic Zones (EEZ) on threatened and endangered species and designated critical habitat, in accordance with section 7 of the ESA. This consultation considers the operation of the stone crab fishery as managed under the Fishery Management Plan for the Stone Crab Fishery of the Gulf of Mexico (SCFMP), including all amendments implemented to date. NMFS has dual responsibilities as both the action agency under the Magnuson-Stevenson Fishery Conservation and Management Act (MSFMCA) (16 U.S.C. §1801 *et seq.*) and the consulting agency under the ESA. For the purposes of this consultation, F/SER2 is considered the action agency and the consulting agency is F/SER3.

This opinion is based on information provided in: the Fishery Management Plan for Stone Crab (GMFMC 1979), Amendment 7 to the Fishery Management Plan for the Stone Crab Fishery of the Gulf of Mexico (GMFMC 2001); sea turtle recovery plans; past and current sea turtle research and population modeling efforts; sea turtle stranding data; smalltooth sawfish encounter database entries; the *Acropora* status review document (*Acropora* BRT 2005); *Acropora cervicornis* and *A. palmata* colonial density estimates (Miller et al. 2007); other relevant scientific data and reports; consultation with F/SER2 staff; and previous opinions on other fisheries.

1.0 Consultation History

An informal consultation was conducted on the impacts of the Fishery Management Plan for the stone crab fishery in the Gulf of Mexico and South Atlantic Fishery Conservation Zone in 1979. It concluded the implementation of a fishery management plan was not likely to jeopardize the continued existence of threatened or endangered sea turtles or marine mammals. The consultation did not analyze the effects of the fishery itself.

The effects of the Gulf of Mexico stone crab fishery on threatened and endangered species were examined again as part of a larger April 28, 1989, opinion, which analyzed the impacts of all commercial fishing activities in the Southeast Region. The opinion stated that there were no known records of threatened or endangered species incidentally taken in the stone crab trap fishery[1] at the time of opinion, and that "the fishery was not likely to impact threatened or endangered species." The opinion concluded that all commercial fishing activities in the Southeast Region were not likely to jeopardize the continued existence of any threatened or endangered species. The incidental take of ten documented green, hawksbill, Kemp's ridley, or leatherback sea turtles; 100 loggerhead sea turtles; and 100 shortnose sturgeon was allotted to each fishery identified in the ITS. The amount of incidental take was later reduced in a July 5, 1989, opinion to only ten documented green, hawksbill, Kemp's ridley, or leatherback sea turtles; 100 loggerhead sea turtles; and 100 shortnose sturgeon for all commercial fishing activities conducted in the Southeast region combined.

Amendments 1 through 7 to the Gulf of Mexico stone crab fishery management plan (FMP) were all consulted on informally and found not likely to adversely affect threatened or endangered species, or were determined by F/SER2 to have no effect on ESA-listed species. These consultations determined that amendments to the FMP would not alter the prosecution of the stone crab fishery in ways that would cause effects to listed species not previously considered. Likewise, they determined there was no new information revealing effects to threatened and endangered species, or their designated critical habitats, not previously considered in the July 5, 1989, opinion.

Formal consultation on the Gulf of Mexico stone crab fishery was reinitiated on August 25, 2005. As provided in 50 CFR 402.16, reinitiation of formal consultation is required when discretionary involvement or control over the action has been retained (or is authorized by law) and: (1) the amount or extent of the incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not previously considered; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action.

In an August 25, 2005, memorandum F/SER2 evaluated the impacts of the implementation of Generic Amendment 3 to the Gulf of Mexico stone crab fishery (Amendment 8 to the stone crab FMP). Since NMFS considers the effects of the specific management measures proposed, and the effects of all discretionary fishing activity authorized under affected FMPs, the operation of the entire fishery was evaluated. The analysis concluded new data were available that revealed the fishery may be affecting ESA-listed species in a way not previously considered. Additionally, the impacts of stone crab fishing on the U.S. distinct population segment (DPS) of smalltooth sawfish and *Acropora* species were not analyzed in previous consultations. Citing the presence of these reinitiating factors, FSER/2 requested reinitiation of formal consultation on the Gulf of Mexico stone crab FMP.

[1] The impacts of other gear types in the stone crab fishery were not analyzed in this opinion.

The original Fishery Management Plan (FMP) for the Gulf of Mexico stone crab fishery was implemented in 1979. The FMP has been amended eight times since its inception. Amendment 1 was implemented on November 8, 1982 (47 FR 41757), and specified a procedure for modifying the zoned area[2] to resolve the gear conflict. The second amendment to the original FMP was implemented on August 31, 1984 (49 FR 30713); it established procedures for resolving gear conflicts in central west Florida. Amendment 3 was implemented on September 25, 1986 (51 FR 30663). That amendment included management measures to enhance the survival of crabs held on board vessels and prohibited the harvest of egg-bearing female crabs. It also rescinded the federal logbook reporting provision and substituted the Florida trip ticket system. Amendment 4 was approved on February 21, 1991 (56 FR 6837), and contained provisions for adding a scientifically measurable definition of overfishing and an action plan to arrest overfishing, should it occur. The amendment also included a section on vessel safety considerations, and a revised habitat section as required by the Magnuson Act (GMFMC 2001).

Amendment 5 was implemented on April 14, 1995 (60 FR 13918) and placed a three-year moratorium on the registration of stone crab vessels, April 15, 1995 - June 30, 1998. This amendment was implemented to coincide with a Florida Legislature proposal to institute a state moratorium on the issuance of permits while the industry considered the development of a limited access system. Amendment 5 also included a protocol and procedure that allowed the NMFS Regional Administrator to approve, for implementation in the EEZ, certain types of rules proposed by the State of Florida after review by the Advisory Panel (AP), Scientific and Statistical Committee (SSC), and Gulf of Mexico Fishery Management Council (Council). Amendment 5 also updated the description of the fishery habitat and the factors affecting this habitat (GMFMC 2001).

Amendment 6 extended the earlier three-year registration moratorium through June 30, 2002. Amendment 7 created a trap reduction program for the EEZ that complemented a similar program for the Florida fishery. The eighth amendment to the FMP addressed the Council's Generic Amendment that prohibited all fishing activities within the Tortugas Marine Reserves.

The specific management objectives of the stone crab FMP are listed below (GMFMC 2001)

1. Provide for an orderly stone crab fishery by reducing conflict between stone crab and shrimp fishermen.
2. Establish and effective statistical reporting system.
3. Attain full utilization of the resource.
4. Promote uniformity of regulations throughout the management area.
5. Provide a more flexible management system that minimizes regulatory delay to assure more effective, cooperative state and federal management of the fishery.

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[2] This was an area closed to shrimp trawling off southwest Florida (see Figure 2.3)

2.2 Overview of Current Regulations

The State of Florida and the Gulf of Mexico Fishery Management Council (GMFMC) manage this fishery jointly (GMFMC 2001). The GMFMC and NMFS both acknowledge that the fishery is primarily a state fishery, and requires cooperative state/federal management. Federal management of the stone crab fishery consists primarily of the concurrent regulations established to support existing State of Florida regulations.

The stone crab management area overlaps jurisdictions of the GMFMC and the South Atlantic Fishery Management Council (SAFMC). Due to this overlap the GMFMC acts as the lead federal agency for developing, amending, and managing the stone crab fishery and its FMP, though any federal management decisions are submitted to the SAFMC for review.[3]

The authorized gears for the federal stone crab fishery are commercial trap/pot, recreational trap/pot, and recreational hand harvest (50 CFR 600.725). The fishery is currently management through spatio-temporal closures, effort limitations, harvest limitations, permit requirements, trap construction requirements, and a passive trap limitation program managed by the State of Florida. Recreational fishers must follow the same guidelines as commercial fishers unless otherwise noted. Table 2.1 briefly summarizes these requirements. These regulations are available in their entirety at 50 CFR 654.

A stone crab trap limitation program (TLP) was passed by the Florida legislature in 2000 and implemented in October 2002. The program was in response to the rapid growth of the fishery that led to an excessive number of traps, leading to declining yields and increasing conflicts between stone crabbers and shrimp trawlers [F.A.C. 68B-13.010(1)]. Approximately 1.57 million stone crab traps were in the fishery at the beginning of the TLP during the 2002-2003 fishing season. The TLP calls for passive reductions in stone crab trap certificates when transferred or sold to another fisher outside of the immediate family. Each certificate entitles the holder to own an individual trap. The percent reduction is dependent upon the statewide total of crab trap certificates available (Table 2.2), until the number of available trap certificates reaches 600,000 (Muller et al. 2006).

[3] Since the vast majority of fishery occurs in the Gulf of Mexico, we refer to this fishery as the Gulf of Mexico stone crab fishery through out the remainder of the document.

Table 2.1 Summary of Stone Crab Fishery Management Measures

Spatio/Temporal Closures
Management Area
Defined as the EEZ off the coast of Florida from a line extending directly south from the Alabama/Florida boundary (87°31'06" W. long.) to a line extending directly east from the Dade/Monroe County, FL boundary (25°20.4' N. lat.) (Figure 2.2).
No person may possess a stone crab in the management area from 12:01 a.m., May 16, through 12 p.m. midnight, local time, October 14, each year.
Southwest Florida Seasonal Trawl Closure
Area off Southwest Florida shoreward of the demarcation line in Figure 2.3
Area closed from January 1 to 1 hour after sunset (local time) May 20, each year.
Shrimp/Stone Crab Separation Zones
Five zones are established in the management area and Florida's waters off Citrus and Hernando Counties for the separation of shrimp trawling and stone crab trapping (see Figure 2.4)
Effort and Harvest Limitations
Trap Limitation Program
This program is meant to complement the stone crab trap limitation program implemented by the Florida Fish and Wildlife Conservation Commission (FFWCC). The federal program requires the issuance of a commercial vessel permit, a trap certificate, and annual trap tags. This documentation is required to possess or use a stone crab trap, possess more than one gallon, or sell stone crab claws in or from the management area. Recreational fishers may collect no more than one gallon of crab claws per person, or two pounds per vessel.
Harvest Requirements
No person may remove from a stone crab in or from the management area, or possess in the management area, a claw with a propodus measuring less than 2.75 inches (7.0 cm).
An egg-bearing stone crab in or from the management area must be returned immediately to the water unharmed--without removal of a claw.
Gear Identification and Trap Construction
Trap and Buoy Identification
A stone crab trap used by or possessed on board a vessel with a federal commercial vessel permit for stone crab must have a valid annual trap tag issued by the RA attached. A buoy must be attached to each stone crab trap or at each end of a string of traps. Each buoy must display the official number and the color code assigned by the RA.
Trap Construction Requirements
Each trap must be constructed of wood, plastic, or wire. No trap is allowed to be larger than 24 by 24 by 24 inches. Several requirements also exist for escape vents, throat, sizes, and configuration; see 50 CFR 654.22 for further information regarding these requirements.

Table 2.2 Passive Stone Crab Trap Reduction Schedule [F.A.C. 68B-13.010(3)(f)]

No. of Trap Certificates Available	% Reduction
More than 1.5 million	25
More that 1.25 million but less than 1.5 million	22.5
More that 1 million but less than 1.25 million	18.5
More that 750,000 but less than 1 million	15
More that 600,000 but less than 750,000	10
600,000 or less	0
Example: If more than 1.5 million certificates remain, the sale of 100 trap certificates outside the immediate family, would authorize the buyer to 75 trap certificates	

Figure 2.1 Number of Trap Certificates Issued

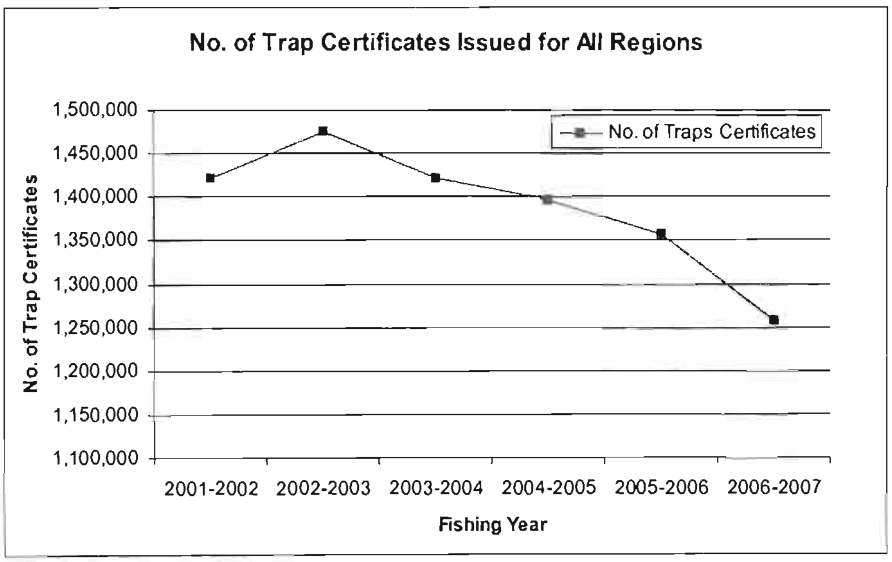


Figure 2.2 Specific Areas Managed Under the Stone Crab FMP

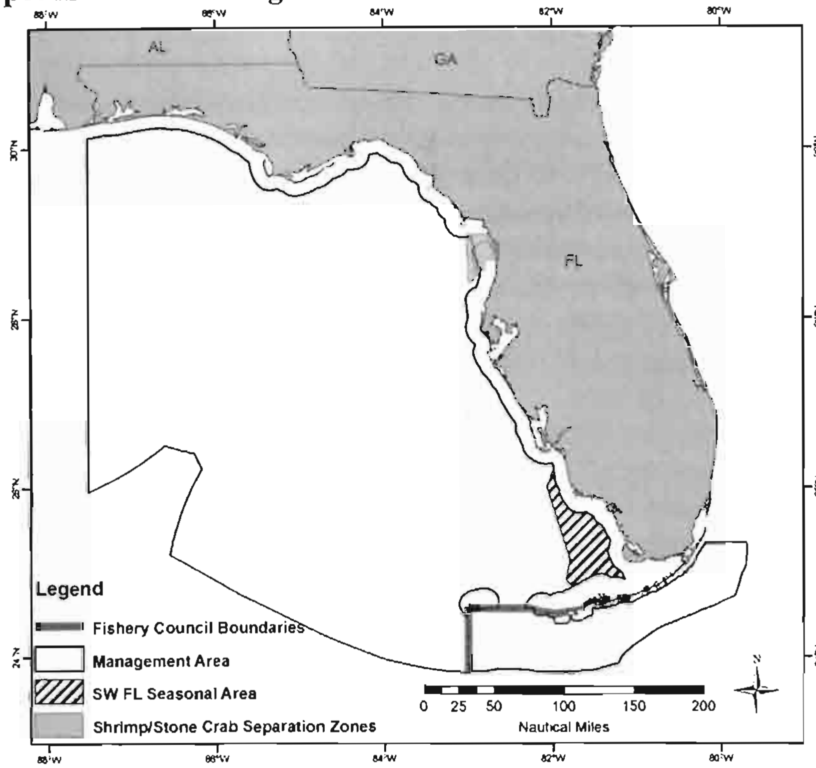


Figure 2.3 Southwest Florida Seasonal Trawl Closure Area

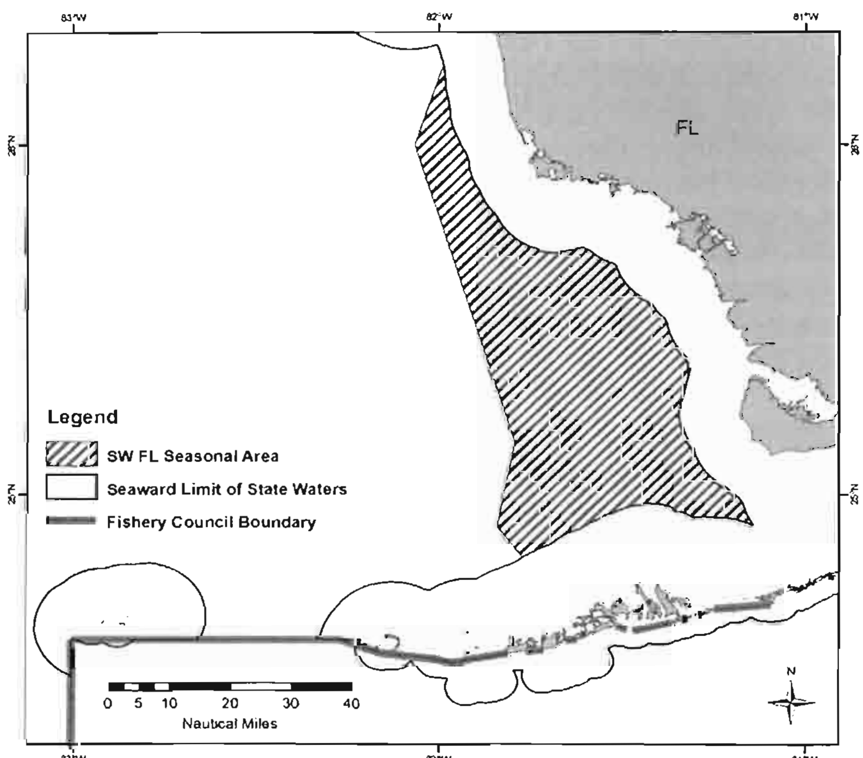
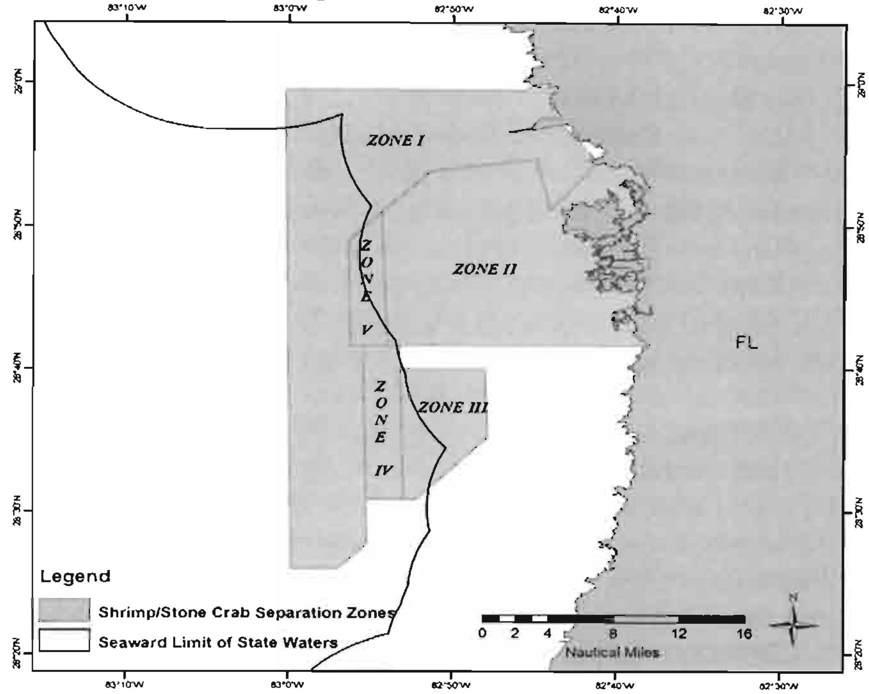


Figure 2.4 Shrimp Stone Crab Separation Zones



2.3 Current Monitoring and Reporting Requirements

Currently, there are no federal reporting requirements for the federal stone crab fishery. Since 1986, the reporting and monitoring of the federal stone crab fishery have been conducted through the Florida Trip Ticket system. A federally managed reporting system was simultaneously implemented with the implementation of the original FMP in 1979. That requirement was rescinded in Amendment 3 to the Stone Crab FMP (GMFMC 1986) due to reporting duplications between the federal monitoring program and a newly instituted Florida Trip Ticket program. Due to the similarities in the reporting requirements and the data collected between these two programs, the federal program was phased out. Since that time, all data regarding the federal stone crab fishing has been collected via partnership with the State of Florida, through its trip ticket program.

2.4 Description of the Fishery

Stone crab fishing in the Gulf of Mexico is unique in that only the claws of the crab are harvested (Muller et al. 2006). The fishery operates primarily nearshore and fishing techniques have changed little since the implementation of the federal Stone Crab Fishery Management Plan. Bert et al. (1978) and GMFMC (1979a) provide an extensive overview of the fishery. The following sections briefly summarize those works.

History of Exploitation

Stone crabs have been sought after as a food source in areas of the U.S. Atlantic coast and Gulf of Mexico, since the 1800s. Markets for stone crabs were generally centered in Key West and Fernadina, Florida; Charleston, South Carolina; and Beaufort, North

Carolina (GMFMC 1979a). Prior to 1962, most stone crabs were harvested incidentally during spiny lobster fishing (Bert et al. 1978).

Historically, the fishery was conducted from shore or from small boats. Fishing usually occurred within one mile of shore, often over rocky bottom and throughout island channels. Fishers most commonly harvested stone crabs with dip nets and traps (Rathburn 1884, 1887). Initially, traps were adapted from containers such as ice cans or oil drums. Coconuts or glass jars were frequently used as marking buoys. Trap bait was frequently trash fish, shark, or ray. Fishers generally fished in waters 30 ft or less and set between 50 and 300 traps. Stone crab fishing was conducted year round, although harvest was best from February to April. In Florida, the historical fishery spanned Monroe, Collier, Manatee, and Pinellas counties (GMFMC 1979a). Effort in the fishery has increased dramatically over the past 40 years. During the 1962-63 fishing season, an estimated 14,000 traps were in use (Bert et al. 1978). In comparison, an estimated 1.6 million traps were fished in the 2001-2002 season (Muller et al. 2006).

2.4.1 Current Commercial and Recreational Utilization

Commercial Vessels
Most commercial stone crab fishing vessels are multi-purpose vessels, set up to fish several different types of gear. The larger crabbing vessels may reach 80 ft in length and are diesel powered. These often operate with crews of three. Smaller vessels (less than 30 ft) are frequently fished by a single individual and run by a gasoline engine (GMFMC 1979a).

Commercial Trap Gear
Traps are the exclusive gear type used to target stone crabs. Fishers often build their own traps or contract their construction out to others. Stone crab traps are constructed of pressure-treated pine or cypress slats or of plastic (Bert et al. 1978). The tops of the traps have a hinged lid that is opened to gain access to the catch. A 4-inch by 6-inch plastic opening in the center of the lid serves as the mouth of the trap, which allows crabs to enter. Fishers pour concrete into the bottoms of these traps to weight them. All traps must be designed to conform to the specifications established under 50 CFR § 654.22, as well as State of Florida Statutes. A marking buoy and line are attached to each trap (GMFMC 1979a).

Commercial Fishing Techniques
Traps are baited with bait fish or fish remnants. Mullet, grouper or snapper heads and skeletons, jacks, sharks, and skates or rays are commonly used baits (GMFMC 1979a). Pigs' feet and cowhide have also become common baits in recent years. One-to-three pounds of bait is generally used per trap. Bait configuration within the trap depends on fisher preference. Some fishers simply place the bait on the bottom of the trap; some place it in a bait container, and others suspend the bait from the top of the trap. Baits may last anywhere from two days to several weeks, depending upon their type, amount, and placement inside the trap (Bert et al. 1978).

Fishing operations on larger vessels are often conducted by three-man crews: a captain, and two trap pullers. Baited traps are frequently set in a double line formation, generally 100-300 ft apart, running parallel to a bottom contour. Some fishers prefer to lay traps in a grid, crisscross, or circular pattern. Traps are usually set on sandy or grassy bottom with scattered sponges, rocks, soft corals, or small coral heads (Bert et al. 1978). The margins of seagrass flats and bottoms with low rocky relief are also favored areas for trap placement (T. Bert, Florida Fish and Wildlife Conservation Commission pers. comm. 2006).

Fishers who operate large vessels usually allow their traps to soak for 10 to 21 days. During retrieval, the captain positions the vessel along side a buoy line, taking care to not entangle the propeller in the line. The trap pullers grab the buoy line and run it through the powered trap puller to haul it on board the vessel. Haulback gear aboard these vessels usually consists of a sheave block mounted on a davit. After the trap has been retrieved, the catch is removed, the trap is re-baited, minor repairs are made to the trap if necessary, and then the trap is reset. To increase efficiency, the captain will motor toward the next trap while catch is being removed and the traps are being reset. The entire process is then repeated for the next trap (Bert et al. 1978). Stone crab fishing is conducted almost entirely during one-day trips because the crabmeat must be cooked before it is frozen to prevent the meat from sticking to the shell (GMFMC 1979a).

Depending on the experience of the crew, a three-man crew may haul and reset anywhere from 25 to 100 traps per hour. This rate is also highly dependent on tide, weather conditions, smoothness of operation, and the condition of equipment. Sixty traps an hour is considered an average rate for larger vessels (Bert et al. 1978). Per season, stone crab fishers operating large vessels may set from 1,500 to 8,000 traps or more; a few leaders in the fishery may own several vessels ranging 60-85 ft in length and fish up to 10,000 traps per season (T. Bert, Florida Fish and Wildlife Conservation Commission, pers. comm. 2006).

Large vessels usually dock free of charge at certain fish processing houses, which provide the fishers with storage and maintenance facilities for their traps. In return, fishers sell their catch to that processor and purchase bait and fuel from the same proprietor (Bert et al. 1978).

Small vessels (30 ft or less) are usually fished by a single captain, although sometimes a family member or friend will assist. These vessels generally fish shallower waters and pull their traps every few days. They use the same techniques described above to set and retrieve their traps, but powered haulback devices are rarely employed. The number of traps worked per day by these single man crews, ranges from less than 25 to 300. Over a season, the number of traps set by these smaller operators varies but may be as high as 1,500 (Bert et al. 1978).

Recreational Gears and Techniques
The recreational sector targeting stone crab can be divided into two groups. The first is composed of trappers that use much of same equipment and techniques as the

commercial trappers described above. The second is composed of divers and waders who collect stone crabs by hand or use sticks and/or snares (Bert et al. 1978).

Most recreational trap fishers fish only a few traps (Florida state regulations limit recreational stone crab trap number to 5 per person [F.A.C. Chapter 68B-13] Florida Statutes]) and set them in shallow water (20 ft or less). They keep most of their catch for personal consumption, although some is given to friends or relatives. Some recreational fishers (illegally) sell a portion of their catch to help offset the cost of fishing. Because no documentation or registration is required for recreational stone crab trapping, no accurate estimate of the magnitude of this fishery is possible (Bert et al. 1978).

Wading for stone crabs is popular on the west coast of Florida from Fort Myers to Cedar Key. Stone crabs often inhabit shallow waters, burrowing into the flats or taking refuge in rocks or jetties during the winter. Wading fishers will enter these areas and harvest stone crabs when available.

Diving for stone crab occurs throughout most of the Florida Gulf of Mexico. Stone crabs are generally not the target species of these fishers, but are taken incidentally to spiny lobster or reef fish fishing (GMFMC 1979a). Crabs are generally caught by teasing them into the water column and grasping the claws while swimming, or by pulling crabs out of their burrows (Bert et al. 1978). Poor water clarity often limits the extent of diving for stone crabs in many areas (GMFMC 1979a).

2.4.2 Regions/Areas of Exploitation

Monroe County, Florida

The stone crab fishery here consists of three distinct components: (1) an Upper Keys component (Long Key to Key Largo); (2) a Marathon component; and (3) a Lower Keys component (south of Marathon). Stone crabbing occurs on both the Gulf of Mexico and Atlantic sides of the Keys, but is by far most extensive in the Gulf of Mexico side. Crabbers place their traps in waters of 65 ft depth or deeper and intense trapping extends from the boundary of Everglades National Park through the Gulf of Mexico side of the Marquesa Keys (T. Bert, Florida Fish and Wildlife Conservation Commission, pers. comm. 2006).

The Upper Keys component is generally comprised of smaller boat operations with one-man crews. These small boats allow for better maneuverability in shallow waters of the Florida Bay to Cape Sable. Most fishers here have 50 to a few thousand traps, process their own catch, and sell it directly to dealers or restaurants (Bert et al. 1978). Fishers out of Marathon generally use large vessels that can accommodate three-man crews. These vessels generally range more widely than the vessels on other areas of the Keys. They set traps deeper than the smaller operations of the Upper and Lower Keys, and often work thousands of traps per season (Bert et al. 1978). Lower Keys stone crabbers fish various sizes of vessels. Their methods encompass those used in both the Upper and Middle Keys, and they generally stay in the shallow waters of the "back country" in the Gulf of

Mexico. In all areas, stone crabs are also landed in this area as incidental catch in the spiny lobster fishery (Bert et al. 1978).

There are few Monroe County stone crabbers that rely on the stone crab fishery as their sole source of income. The open season is only seven months long (October 15-May 15) and these fishers frequently participate in other fisheries during this closed season. In the Middle and Lower Keys, a number of stone crabbers also harvest mackerel and kingfish during the open seasons for these species (T. Bert, Florida Fish and Wildlife Conservation Commission, pers. comm. 2006). Throughout Monroe County, many stone crab fishers also fish for spiny lobster because of the similarities between the gears and techniques used in these two fisheries (Bert et al.. 1978).

Collier County, Florida
The stone crab fishery off Collier County is centered in Chokoloskee. It generally extends from the Shark River Basin to Cape Romano and seaward to approximately 65 ft depth. Most fishing operations are composed of two- and three-man crews. Fishers generally work from 1,000 to 3,000 traps per season; a few crabbers fish as many as 8,000 traps per season (Bert et al. 1978; T. Bert, pers. comm. 2008).

Stone crab fishers in Collier County rely heavily on crabbing. Many of them derive a significant share of their income from crabbing. Some of these fishers also fish for spiny lobster, but due to locally depleted numbers of spiny lobster by the opening of stone crab season, most switch exclusively to crabbing after the stone crab fishing season opens (Bert et al. 1978).

Lee and Charlotte Counties, Florida
Fishers in these areas tend to fish smaller vessels (20-25 ft) with two-man crews. Many vessels are without powered mechanisms to haul traps. The fishers often fish waters less than 20 ft deep, and fish fewer than 200 traps per season. Most stone crab fishers in these areas crab part-time and hold other jobs not related to the fishing industry. Shrimp or mullet fishers may also engage in crabbing on the weekends or when not fishing those species. Crab claws from these areas are often sold to fish processor dealing primarily with shrimp or finfish. Crabbers in these areas may also sell claws directly to local restaurants (GMFMC 1979a).

Sarasota to Hernando Counties, Florida
Stone crabbers in the vicinity of Tampa Bay and Sarasota Bay operate small and mid-sized boats (to approximately 40 ft in length) and fish a few hundred to a few thousand traps. Most operate singly or with one crew member and also fish for other species (particularly mullet). Many stone crabbers operate from Tarpon Springs and Homosassa. Most of these crabbers operate 30- to 50-ft boats, have two- or three-man crews, and deploy thousands of traps. The stone crab fishery offshore from this area appears to be the most heavily fished of any area in the state (T. Bert, unpublished data).

Cedar Keys, Florida Region
This region is composed of Taylor, Dixie, Levy, and Citrus Counties. Most crabbing operations in this area are one- and two-man crews, working from smaller boats (20- to 30-ft), sometimes without powered trap retrieval gear. These fishers may use up to 1,000 traps per season (GMFMC 1979a). Most stone crab fishers in this region also net-fish for mullet, baitfish, and other food fish to supplement their incomes. The "net ban" constitutional amendment instituted by the State of Florida in 1995 notably depleted the stone crabbing fleet in Cedar Key because these fishers could no longer sustain a livelihood by fishing. The Florida Sea Grant Program and other state agencies promoted hard clam (*Mercenaria* spp.) aquaculture to provide an alternative income source for these people. Many stone crab fishers switched to this occupation and relinquished their stone crab fishing licenses. However, stone crabbing is still a robust industry in coastal towns farther north in this region. A number of stone crabbers are based in Steinhatchee and St. Marks. The size of their operations varies widely. They range from fishers who use small boats, fish singly, have a few hundred traps, and fish nearshore to fishers who lead three-man crews, have vessels of 40 ft or more, fish a few thousand traps and range out to 25 or 30 ft depth (which can be 25-30 miles offshore) (T. Bert, pers. comm. 2006).

Florida Panhandle Region
There are few stone crabbers in this area. The length of the active stone crab season in this area is highly dependent upon weather, and varies considerably. The blue crab industry is much more lucrative in this region and blue crab processors are reluctant to buy and process stone crab claws. Crabbers in this region also see far lower ex-vessel prices than their counterparts in south Florida. Stone crab catch in this area tends to be incidental catch during directed blue crab fishing (T. Bert, pers. comm. 2008).

2.5 Management of Gulf of Mexico Stone Crab Exempted Fishing, Scientific Research, and Exempted Educational Activity

Regulations at 50 CFR 600.745 allow the Regional Administrator of NMFS' SERO to authorize the target or incidental harvest of species managed under an FMP or fishery regulations that would otherwise be prohibited, for scientific research activity, limited testing, public display, data collection, exploratory health and safety, environmental cleanup, hazardous waste removal purposes, or educational purposes. Every year, SERO may issue a small number (e.g., one was issued in 2005 and none were issued in 2006 or 2007) of exempted fishing permits (EFPs), scientific research permits (SRPs), and/or exempted educational activity authorizations (EEAAs). Such a permit would exempt the collection of a limited number of stone crab, occurring in Gulf of Mexico and South Atlantic federal waters, from regulations implementing the SCFMP. These EFPs, SRPs, and EEAAs involve fishing by commercial or research vessels, using fishing methods similar or identical to those used in the stone crab fishery. Under these circumstances, 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 methods are similar and the associated fishing effort does not represent a significant increase beyond the levels expected in the fishery considered herein, 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 is unlikely to add additional effects or increase fishing effort beyond what is otherwise likely to accrue from the vessel's normal commercial activities. Therefore, we consider SERO's issuance of EFPs, SRPs, and EEAAs for fishing that is consistent with the description of stone crab fishing in Section 2, and is not expected to increase fishing effort significantly, to be within the scope of this opinion.

2.6 Action Area

The action area for a biological opinion is defined as the area affected, directly or indirectly, by the federal action and not merely the immediate area where the action is occurring. The federal stone crab fishery is managed inside the federal management area; defined as the EEZ off the coast of Florida from a line extended directly south from the Florida/Alabama border (87°31'06" W. longitude) to a line extending directly east from Dade/Monroe County, Florida boundary (25°20'23"N. latitude) (Figure 2.1) (50 CFR 654.2). Throughout its authorized range of operation, the stone crab fishery may affect one or more of the listed species known to occur within the management area (detailed discussion to follow in Section 3). Therefore, the action area for this consultation includes the area circumscribed by federal stone crab management area.

3.0 Status of Species and Critical Habitat in the Action Area

Marine Mammals	**Status**
Blue whale (*Balaenoptera musculus*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
North Atlantic right whale (*Eubalaena glacialis*)	Endangered
Sea Turtles	
Green sea turtle (*Chelonia mydas*)	Endangered/Threatened*
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered
Loggerhead sea turtle (*Caretta caretta*)	Threatened
Invertebrates	
Elkhorn coral (*Acropora palmata*)	Threatened
Staghorn coral (*Acropora cervicornis*)	Threatened
Fish	
Smalltooth sawfish (*Pristis pectinata*)	Endangered**
Gulf sturgeon (*Acipenser oxyrinchus desotoi*)	Threatened

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

Critical Habitat

Acropora critical habitat has been designated in the action area. The Florida area contains three sub-areas: (1) The shoreward boundary for Florida sub-area A begins at the 6-ft (1.8 m) contour at the south side of Boynton Inlet, Palm Beach County at 26° 32' 42.5" N; then runs due east to the point of intersection with the 98-ft (30 m) contour; then follows the 98-ft (30 m) contour to the point of intersection with latitude 25° 45' 55" N, Government Cut, Miami-Dade County; then runs due west to the point of intersection with the 6-ft (1.8 m) contour, then follows the 6-ft (1.8 m) contour to the beginning point; (2) The shoreward boundary of Florida sub-area B begins at the MLW line at 25° 45' 55" N, Government Cut, Miami-Dade County; then runs due east to the point of intersection with the 98-ft (30 m) contour; then follows the 98-ft (30 m) contour to the point of intersection with longitude 82° W; then runs due north to the point of intersection with the South Atlantic Fishery Management Council (SAFMC) boundary at 24° 31' 35.75" N; then follows the SAFMC boundary to a point of intersection with the MLW line at Key West, Monroe County; then follows the MLW line, the SAFMC boundary (see 50 CFR 600.105(c)), and the COLREGS line (see 33 CFR 80.727. 730, 735, and 740) to the beginning point; and (3) The seaward boundary of Florida sub-area C (the Dry Tortugas) begins at the northern intersection of the 98-ft (30 m) contour and longitude 82° 45' W; then follows the 98-ft (30 m) contour west around the Dry Tortugas, to the southern point of intersection with longitude 82° 45' W; then runs due north to the beginning point.

3.1 Species and Critical Habitat Not Likely to be Adversely Affected

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

Blue, Sei, and Sperm Whales
The proposed action is not likely to adversely affect blue, sei, or sperm whales. In the Gulf of Mexico and South Atlantic region, blue, sei, and sperm whales are predominantly found seaward of the continental shelf. 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 East Coast (CETAP 1982, Wenzel et al. 1988, Waring et al. 2002 and 2006). The depth at which these species are found makes any interaction with the stone crab fishery extremely unlikely. The hand harvest methods used in the fishery (scuba and wading) will not affect these species. These methods can only be safely prosecuted at depths much shallower than these species prefer. Traps used to commercially harvest stone crabs in the federal fishery are also not likely to adversely affect these species. Trap fishing within the action area occurs primarily in the Florida Keys and along the Gulf Coast on shallow sand flats and seagrass beds. These species only rarely, if ever, occur in shallow sand flats and seagrass beds. There are no documented take of these species by the stone crab fishery (74 FR 27739; June 11, 2009). For these reasons, NMFS believes the likelihood of these species being adversely effected by the proposed action is extremely low and therefore discountable.

Fin Whales
The proposed action is not likely to adversely affect fin whales. Fin whales are frequently found along the U.S. east coast, north of Cape Hatteras, North Carolina. They are also closely associated with the 100 m isobath, with sightings also spread over deeper water including canyons along the shelf break (Waring et al. 2006). Fin whales may occur in the action area, but their association with the 100 m isobath and shelf break greatly reduces any potential for interaction with stone crab fishing, which is generally concentrated on shallow sand flats and seagrass beds. The hand harvest methods used in the fishery (scuba and wading) do not occur at depths where fin whales are commonly found and will not affect them. Trap fishing within the action area occurs primarily in

the Florida Keys and along the Gulf Coast, in waters much shallower than 100 m and are also not likely to adversely affect fin whales.

Additionally, the proposed 2010 List of Fisheries (74 FR 27739; June 11, 2009) lists the Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot as a Category III Fishery under the MMPA. Category III fisheries are those where annual mortality and serious injury of a stock resulting from a fishery is less than or equal to one percent of the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. There has never been documented interaction or take of a large whale with a stone crab trap since the List of Fisheries was implemented in 1996. For these reasons, NMFS believes the likelihood of this species being adversely affected by the proposed action is extremely low and therefore discountable.

Humpback Whales

The proposed action is not likely to adversely affect humpback whales. Humpback whales are considered coastal whale species but not commonly found in the Gulf of Mexico. They are sighted most frequently in the South Atlantic along the southeastern U.S. from November through March on their migration south. December and January are peak times for humpbacks to occur off North Carolina as they migrate southward through coastal waters to their wintering grounds, with a second peak occurrence in March and April as they migrate north again to their summer feeding grounds. These animals' migration patterns rarely, if ever, overlap the stone crab management area. The hand harvest methods used in the fishery (scuba and wading) will not affect humpback whales. Humpbacks will not occur in waters where wading for stone crab would take place. Scuba diving is also extremely unlikely to adversely affect humpback whales. We believe any humpback coming in close proximity to divers would change their route to avoid them and any behavioral effects resulting from the presence of divers will be insignificant.

Traps used to commercially harvest stone crabs in the federal fishery are also not likely to adversely affect humpback whales. Trap fishing within the action area occurs primarily in the Florida Keys and along the Gulf Coast. Humpback whales occur only very rarely in areas where the trap fishery may occur. From 1992-2008, no humpback whale were observed in the stone crab management area (Read et al. 2009). Additionally, there are no documented takes of these species by the stone crab fishery (74 FR 27739; June 11, 2009). For these reasons, NMFS believes the likelihood of this species being adversely affected by the proposed action is extremely low and therefore discountable.

North Atlantic Right Whales

The continued authorization of the Gulf of Mexico stone crab trap fishery is not likely to adversely affect right whales. North Atlantic right whales are not likely to occur in the action area. These animals' migration patterns rarely, if ever, overlap the stone crab management area. The hand harvest methods used in the fishery (scuba and wading) will not affect right whales. Right whales will not occur in waters where wading for stone crab would take place. Scuba diving is also extremely unlikely to adversely affect right whales. We believe any right whales coming in close proximity to divers would change their route to avoid them and any behavioral effects resulting from the presence of divers will be insignificant.

Traps used to commercially harvest stone crabs in the federal fishery are also not likely to adversely affect right whales. Trap fishing within the action area occurs primarily in the Florida Keys and along the Gulf Coast. Right whales occur only very rarely in areas where the trap fishery may occur. From 1935-2008, 834 right whales sightings have been documented in the U.S. Atlantic and Gulf of Mexico (Read et al. 2008). However, only three were documented in the stone crab management area; one in 1963 (CeTAP 1982), and two in 1994 (Roden and Thompson 1994). NMFS' List of Fisheries has never documented an interaction between a large whale and a stone crab trap since the List of Fisheries was implemented in 1996. For these reasons, NMFS believes the likelihood of this species being adversely affected by trap gear is extremely low and therefore discountable.

Gulf Sturgeon

Gulf sturgeon are not likely to be adversely affected by the proposed action. The Gulf sturgeon is an anadromous fish, inhabiting coastal rivers from Louisiana to Florida during the warmer months and over-wintering in estuaries, bays, and the Gulf of Mexico. Available data indicates Gulf sturgeon in the estuarine and marine environment show a preference for sandy shoreline habitats with water depths less than 3.5 m and salinity less than 6.3 parts per thousand (ppt) (Fox and Hightower 1998, Parauka et al. 2001). The federal stone crab fishery in the Gulf of Mexico operates well outside of the preferred habitat and salinity ranges of Gulf sturgeon. For these reasons, NMFS believes the likelihood of this species being adversely affected by the proposed action is extremely low and therefore discountable.

Elkhorn and Staghorn Corals

Commercial diving and recreational diving and wading for stone crab is not likely to adversely affect elkhorn and staghorn corals. Stone crabs occur in areas very poorly suited to support these corals (i.e., seagrass beds and mud/sand flats). Diving and wading for stone crabs occurs in these areas, in relatively shallow water, and requires visual contact with stone crabs. Once located, crabs are teased into the water column, away from benthic features, where they are captured. Divers and waders targeting stone crabs in these manners can easily avoid any elkhorn and staghorn corals occurring there. Therefore, we anticipate adverse effects to elkhorn and staghorn corals from diving/wading for stone crabs are extremely unlikely to occur and therefore discountable.

Commercial and recreational trapping for stone crab will not adversely affect elkhorn and staghorn corals. Throughout the Upper, Middle, and Lower Keys, Matthews (2003) documented the distribution stone crab traps over 16 different habitat types. The vast majority (93 percent) of stone crab traps were associated with seagrass beds, sand/mud flats or low relief hard-bottom (Matthews 2003). Elkhorn coral is rare and only sparsely distributed in the action area. Where found, it is closely associated with coral reef habitats, especially high-relief spur-and-groove coral formations (Miller et al. 2007).

None of the habitats where stone crab traps were found supports elkhorn coral colonies. Of the habitats where Matthews (2003) noted stone crab trap occurrence, staghorn coral has only been documented in low relief hardbottom areas occurring the in Lower keys (Miller et al. 2007). However, stone crab trap fishing in the Lower Keys occurs primarily in the Gulf of Mexico and staghorn coral has not been found in these areas. The relative rarity of elkhorn and staghorn corals in the action area coupled with use of stone crab traps in areas that do not support these species (i.e., seagrass beds and mud/sand flats), leads us to believe any adverse effects from commercial or recreational stone crab trapping are extremely unlikely to occur and therefore discountable.

Acropora Critical Habitat

The physical or biological feature of elkhorn and staghorn (*"Acropora")* critical habitat essential to their conservation (typically referred to as the primary constituent element, PCE) is consolidated hardbottom or dead coral skeleton that is free from fleshy macroalgae cover and sediment cover, occurring in water depths from the mean high water (MHW) line to 30 meters (98 feet). This feature has been identified in four locations within the jurisdiction of the United States: Florida, Puerto Rico, St. Thomas/St. John, and St. Croix. Only the Florida area falls within the action area. The Florida area contains three sub-areas: (1) The shoreward boundary for Florida sub-area A begins at the 6-ft (1.8 m) contour at the south side of Boynton Inlet, Palm Beach County at 26° 32' 42.5" N; then runs due east to the point of intersection with the 98-ft (30 m) contour; then follows the 98-ft (30 m) contour to the point of intersection with latitude 25° 45' 55" N, Government Cut, Miami-Dade County; then runs due west to the point of intersection with the 6-ft (1.8 m) contour, then follows the 6-ft (1.8 m) contour to the beginning point; (2) The shoreward boundary of Florida sub-area B begins at the MLW line at 25° 45' 55" N, Government Cut, Miami-Dade County; then runs due east to the point of intersection with the 98-ft (30 m) contour; then follows the 98-ft (30 m) contour to the point of intersection with longitude 82° W; then runs due north to the point of intersection with the South Atlantic Fishery Management Council (SAFMC) boundary at 24° 31' 35.75" N; then follows the SAFMC boundary to a point of intersection with the MLW line at Key West, Monroe County; then follows the MLW line, the SAFMC boundary (see 50 CFR 600.105(c)), and the COLREGS line (see 33 CFR 80.727. 730, 735, and 740) to the beginning point; and (3) The seaward boundary of Florida sub-area C (the Dry Tortugas) begins at the northern intersection of the 98-ft (30 m) contour and longitude 82° 45' W; then follows the 98-ft (30 m) contour west around the Dry Tortugas, to the southern point of intersection with longitude 82° 45' W; then runs due north to the beginning point (Figure 3.1)(73 FR 72210; November 26, 2008). *Acropora* critical habitat does not occur in the Gulf of Mexico. However, a small portion of the stone crab management area overlaps critical habitat occurring south of the U.S. Highway 1 in the Florida Keys, in the South Atlantic region.

Commercial/recreational diving or wading for stone crabs does not affect consolidated hardbottom or dead coral skeletons. The vast majority of these activities occur in seagrass beds, mud/sand flats, or low relief hardbottom, where the identified PCE occurs so rarely, if at all, that any adverse affect on it is insignificant.

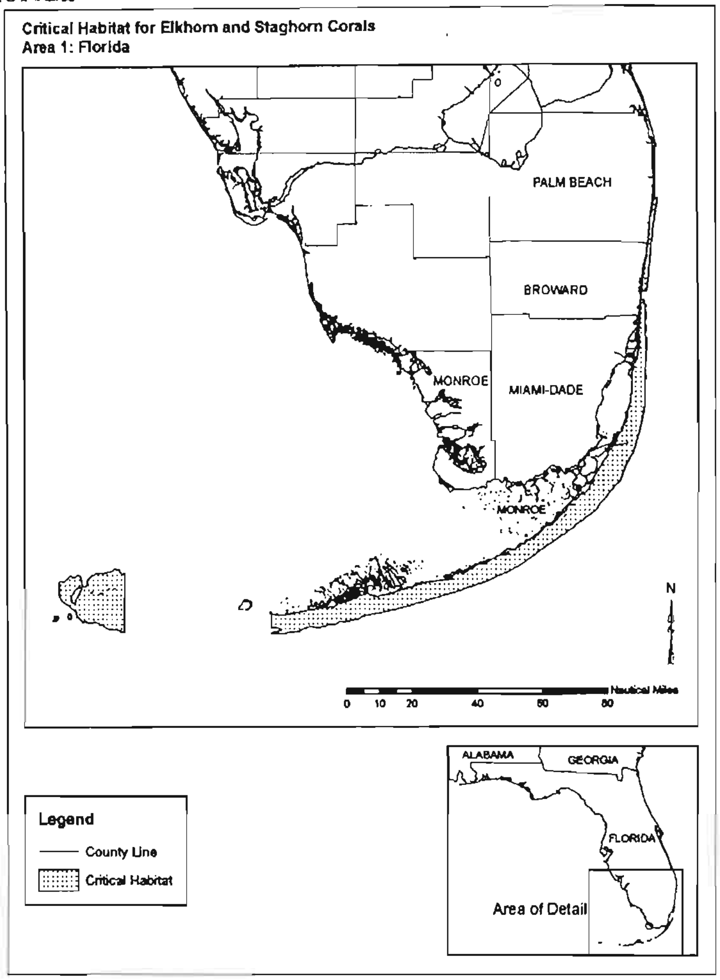
Commercial/recreational trapping is also not likely to adversely affect *Acropora* critical habitat. Most federal stone crab trapping effort occurs outside *Acropora* critical habitat (north of U.S. Highway 1). However, even when it does occur on top of consolidated hardbottom, the proposed action will not appreciably alter the physical or biological features essential for conservation. Traps do not cause consolidated hardbottom to become unconsolidated, nor do they cause growth of macroalgae or cause sedimentation. For these reasons, we believe the annual deployment of traps will have no effect on consolidated hardbottom, macroalgal growth, or sedimentation, and we do not expected cumulative effects from trap deployment year after year. A trap could temporarily cover an area with the desired physical or biological characteristics. However, once a trap is retrieved the area it covered immediately becomes available. Therefore, we believe that trap impacts to *Acropora* critical habitat will be temporary and of such limited scope, that any adverse effects will be insignificant.

Likewise, any adverse effects to dead coral skeletons from stone crab trap fishing are discountable. Potential adverse effects are reduced because the vast majority of *Acropora* critical habitat occurs outside the action area. No estimates are available regarding the number of dead coral skeletons in the portion of the action area that overlaps *Acropora* critical habitat. NMFS (2009) estimated that 184,280,928 square meters of *Acropora* supporting habitat (ASH)[4] existed in the Florida Keys; the region where the action area does overlap critical habitat. If we assume dead coral skeletons covered the entire area of ASH, an extremely unlikely condition, only 0.57 percent[5] would have been impacted by stone crab trap fishing during the 2005-2006 through 2007-2008 fishing years. Under conditions more representative of the natural environment, we believe trap impacts to dead coral skeletons would be orders of magnitude lower. This calculation indicates that the rates of interaction between traps and dead coral skeletons are incredibly low even in this unlikely, but conservative, scenario. Thus, we believe any adverse effects to dead coral skeletons from stone crab trap fishing are discountable.

[4] For our analysis of the federal fishery, we considered ASH to be coral or hardbottom areas, from 0 to 30 m depth, occurring in areas open to fishing, in federal waters.

[5] This estimate was producing using the following formula: [Total number of traps fished in federal waters 2005/06-2007/08 (15,074,500) x Percent likely to land on ASH (19 percent; adapted from Matthews 2003) x Footprint of a trap (0.37 square meter)] ÷ Total area of ASH (184,820,928 square meters).

Figure 3.1 Map of the Elkhorn and Staghorn Critical Habitat Designated in Florida



3.2 Analysis of the Species Likely to be Adversely Affected

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

(Simpfendorfer 2001, Seitz and Poulakis 2002, Simpfendorfer and Wiley 2004, Poulakis and Seitz 2004).

3.2.1 Green Sea Turtle

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

3.2.1.1 Pacific Ocean

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

Hawaiian green turtles are genetically distinct and geographically isolated, and the population appears to be increasing in size despite the prevalence of fibropapilloma and spirochidiasis (Aguirre et al. 1998 in Balazs and Chaloupka 2003). The East Island nesting beach in Hawaii is showing a 5.7 percent annual growth rate over 25 plus years (Chaloupka et al. 2007). In the eastern Pacific, mitochondrial DNA analysis has indicated that there are three key nesting populations: Michoacán, Mexico; Galapagos Islands, Ecuador; and Islas Revillagigedos, Mexico (Dutton 2003). The number of nesting females per year exceeds 1,000 females at each site (NMFS and USFWS 2007a). However, historically, greater than 20,000 females per year are believed to have nested in Michoacán, alone (Cliffton et al. 1982, NMFS and USFWS 2007a). Thus the current number of nesting females is still far below what has historically occurred. There is also sporadic green turtle nesting along the Pacific coast of Costa Rica. However, at least a few of the non-Hawaiian nesting stocks in the Pacific have recently been found to be undergoing long-term increases. Data sets over 25 years in Chichi-jima, Japan, Heron Island, Australia, and Raine Island, Australia, show increases (Chaloupka et al. 2007). These increases are thought to be the direct result of long-term conservation measures.

3.2.1.2 Indian Ocean

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

3.2.1.3 Atlantic Ocean

Life History and Distribution

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

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

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

Population Dynamics and Status

Some of the principal feeding pastures in the western Atlantic Ocean include the upper west coast of Florida and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito Lagoon and Indian

River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Caribbean coast of Panama, the Miskito Coast in Nicaragua, and scattered areas along Colombia and Brazil (Hirth 1997). The summer developmental habitat for green turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus 1997).

The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Meylan et al. 1995, Johnson and Ehrhart 1994). Green sea turtle nesting in Florida has been increasing since 1989 (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute Index Nesting Beach Survey Database). Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The 5-year status review for the species identified eight geographic areas considered to be primary sites for green sea turtle nesting in the Atlantic/Caribbean and reviewed the trend in nest count data for each (NMFS and USFWS 2007a). These include: (1) Yucatán Peninsula, Mexico, (2) Tortuguero, Costa Rica, (3) Aves Island, Venezuela, (4) Galibi Reserve, Suriname, (5) Isla Trindade, Brazil, (6) Ascension Island, United Kingdom, (7) Bioko Island, Equatorial Guinea, and (8) Bijagos Achipelago (Guinea-Bissau) (NMFS and USFWS 2007a). Nesting at all of these sites was considered to be stable or increasing with the exception of Bioko Island and the Bijagos Archipelago where the lack of sufficient data precluded a meaningful trend assessment for either site (NMFS and USFWS 2007a). Seminoff (2004) likewise reviewed green sea turtle nesting data for eight sites in the western, eastern, and central Atlantic, including all of the above with the exception that nesting in Florida was reviewed in place of Isla Trindade, Brazil. Seminoff (2004) concluded that all sites in the central and western Atlantic showed increased nesting with the exception of nesting at Aves Island, Venezuela, while both sites in the eastern Atlantic demonstrated decreased nesting. These sites are not inclusive of all green sea turtle nesting in the Atlantic. However, other sites are not believed to support nesting levels high enough that would change the overall status of the species in the Atlantic (NMFS and USFWS 2007a).

By far, the most important nesting concentration for green turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007a). Nesting in the area has increased considerably since the 1970s and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007a). The number of females nesting per year on beaches in the Yucatán, Aves Island, Galibi Reserve, and Isla Trindade number in the hundreds to low thousands, depending on the site (NMFS and USFWS 2007a). In the United States, certain Florida nesting beaches have been designated index beaches. Index beaches were established to standardize data collection methods and effort on key nesting beaches. The pattern of green turtle nesting shows biennial peaks in abundance with a generally positive trend during the ten years of regular monitoring since establishment of the index beaches in 1989, perhaps due to increased protective legislation throughout the Caribbean (Meylan et al. 1995). An average of 5,039 green turtle nests were laid annually in Florida between 2001 and 2006, with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a). Data from index nesting beaches program in Florida support the dramatic increase in nesting.

In 2007, there were 9,455 green turtle nests found just on index nesting beaches, the highest since index beach monitoring began in 1989. The number fell back to 6,385 in 2008, but that is thought to be part of the normal biennial nesting cycle for green turtles (FWCC Index Nesting Beach Survey Database). Occasional nesting has been documented along the Gulf coast of Florida, at southwest Florida beaches, as well as the beaches on the Florida Panhandle (Meylan et al. 1995). More recently, green turtle nesting occurred on Bald Head Island, North Carolina; just east of the mouth of the Cape Fear River; on Onslow Island; and on Cape Hatteras National Seashore. Increased nesting has also been observed along the Atlantic coast of Florida, on beaches where only loggerhead nesting was observed in the past (Pritchard 1997). Recent modeling by Chaloupka et al. (2007) using data sets of 25 years or more has resulted in an estimate of the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9 percent, and the Tortuguero, Costa Rica, population growing at 4.9 percent annually.

There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas (where they come to forage) of the southeastern United States. However, information on incidental captures of immature green sea turtles at the St. Lucie Power Plant (they have averaged 215 green sea turtle captures per year since 1977) in St. Lucie County, Florida (on the Atlantic coast of Florida), show that the annual number of immature green sea turtles captured has increased significantly in the past 26 years (FPL 2002). Ehrhart et al. (2007) has also documented a significant increase in in-water abundance of green turtles in the Indian River Lagoon area. It is likely that immature green sea turtles foraging in the southeastern United States come from multiple genetic stocks; therefore, the status of immature green sea turtles in the southeastern United States might also be assessed from trends at all of the main regional nesting beaches, principally Florida, Yucatán, and Tortuguero.

Threats

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

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

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

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

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

3.2.1.4 Summary of Status for Atlantic Green Sea Turtles

Green turtles range in the western Atlantic from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean, but are considered rare in benthic areas north of Cape Hatteras (Wynne and Schwartz 1999). Green turtles face many of the anthropogenic threats described above. In addition, green turtles are also susceptible to fibropapillomatosis, which can result in death. In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart 1979). Recent population estimates for the western Atlantic area are not available. The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the almost 20 years of regular monitoring since establishment of index beaches in Florida in 1989. However, given the species' late sexual maturity, caution is warranted about over-interpreting nesting trend data collected for less than 20 years.

3.2.2 Hawksbill Sea Turtle

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

3.2.2.1 Indian Ocean

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

3.2.2.2 Pacific Ocean

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

3.2.2.3 Atlantic Ocean

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

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

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

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

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

Threats
As with other sea turtle species, hawksbill sea turtles are affected by habitat loss, habitat degradation, marine pollution, marine debris, fishery interactions, and poaching in some parts of their range. A complete list of other indirect factors can be found in NMFS SEFSC (2001). There continues to be a black market for hawksbill shell products ("tortoiseshell"), which likely contributes to the harvest of this species.

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

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

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

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

3.2.2.4 Summary of Status for Hawksbill Sea Turtles

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

3.2.3 Kemp's Ridley Sea Turtle

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

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

Little is known of the movements of the post-hatchling stage (pelagic stage) within the Gulf of Mexico. Studies have shown the post-hatchling pelagic stage varies from 1-4 or more years, and the benthic immature stage lasts 7-9 years (Schmid and Witzell 1997). Benthic immature Kemp's ridleys have been found along the Eastern Seaboard of the U.S. and in the Gulf of Mexico. Atlantic benthic immature sea turtles travel northward as the water warms to feed in the productive, coastal waters off Georgia through New England, returning southward with the onset of winter (Lutcavage and Musick 1985, Henwood and Ogren 1987, Ogren 1989). Studies suggest that benthic immature Kemp's ridleys stay in shallow, warm, nearshore waters in the northern Gulf of Mexico until cooling waters force them offshore or south along the Florida coast (Renaud 1995).

Stomach contents of Kemp's ridleys along the lower Texas coast consisted of nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards (Shaver 1991). A 2005 dietary study of immature Kemp's ridleys off southwest Florida documented predation on benthic tunicates, a previously undocumented food source for this species (Witzell and Schmid 2005). These pelagic stage Kemp's ridleys presumably feed on the available *Sargassum* and associated infauna or other epipelagic species found in the Gulf of Mexico.

Population Dynamics and Status
Of the seven extant species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the Rancho Nuevo beaches (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s nesting numbers were below 1,000

(with a low of 702 nests in 1985). However, observations of increased nesting (with 6,277 nests recorded in 2000) suggest that the decline in the ridley population has stopped and the population is now increasing (USFWS 2000). The number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3 percent per year from 1985 to 1999 (TEWG 2000). These trends are further supported by 2004-2007 nesting data from Mexico. The number of nests over that period has increased from 7,147 in 2004, to 10,099 in 2005, to 12,143 in 2006, and 15,032 during the 2007 nesting season (Gladys Porter Zoo 2007). An unofficial estimate for 2008 stands at 17, 882 nests (S. Epperly, NMFS, SEFSC, pers. comm.). A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 128 in 2007, and a record 195 in 2008 (National Park Service data).

A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles beginning in 1990. The increased survivorship of immature sea turtles is attributable, in part, to the introduction of TEDs in the United States' and Mexico's shrimping fleets. As demonstrated by nesting increases at the main nesting sites in Mexico, adult ridley numbers have increased over the last decade. The population model used by TEWG (2000) projected that Kemp's ridleys could reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015. Recent calculations of nesting females determined from nest counts show that the population trend is increasing towards that recovery goal, with an estimate of 4,047 nesters in 2006 and 5,500 in 2007 (NMFS and USFWS 2007c, Gladys Porter Zoo 2007).

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

Threats

Kemp's ridleys face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, natural predators at sea, and oceanic events such as cold-stunning. Although cold-stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. For example, in the winter of 1999-2000, there was a major cold-stunning event where 218 Kemp's ridleys, 54 loggerheads, and 5 green sea turtles were found on Cape Cod beaches (R. Prescott, NMFS, pers. comm. 2001).

Annual cold-stunning events do not always occur at this magnitude; the extent of episodic major cold-stun events may be associated with numbers of sea turtles utilizing Northeast waters in a given year, oceanographic conditions, and the occurrence of storm events in the late fall. Many cold-stunned sea turtles can survive if found early enough, but cold-stunning events can still represent a significant cause of natural mortality. A complete list of other indirect factors can be found in NMFS SEFSC (2001).

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

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

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

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

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

3.2.3.1 Summary of Kemp's Ridley Status

The only major nesting site for Kemp's ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963). The number of nests observed at Rancho Nuevo and nearby beaches increased from 1985 to 2008. Nesting has also exceeded 12,000 nests per year from 2004-2008 (Gladys Porter Zoo database). Kemp's ridleys mature at an earlier age (7-15 years) than other chelonids; thus, 'lag effects' as a result of unknown impacts to the non-breeding life stages would likely have been seen in the increasing nest trend beginning in 1985 (USFWS and NMFS 1992).

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

3.2.4 Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its global range on June 2, 1970. Leatherbacks are widely distributed throughout the oceans of the world and are found in waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972). Leatherback sea turtles are the largest living turtles and range farther than any other sea turtle species. The large size of adult leatherbacks and their tolerance to relatively low temperatures allows them to occur in northern waters such as off Labrador and in the Barents Sea (NMFS and USFWS 1995). Adult leatherbacks forage in temperate and subpolar regions from 71°N to 47°S latitude in all oceans and undergo extensive migrations to and from their tropical nesting beaches. In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982). That number, however, is probably an overestimation as it was based on a particularly good nesting year in 1980 (Pritchard 1996). By 1995, the global population of adult females had declined to 34,500 (Spotila et al. 1996). Pritchard (1996) also called into question the population estimates from Spotila et al. (1996), and felt they may be somewhat low, because it ended the modeling on data from a particularly bad nesting year (1994) while excluding nesting data from 1995, which was a good nesting year. However, the most recent population estimate for leatherback sea turtles from just the

North Atlantic breeding groups is a range of 34,000-90,000 adult individuals (20,000-56,000 adult females) (TEWG 2007).

3.2.4.1 Indian Ocean

Long-term leatherback nesting data for many areas of the Indian Ocean are not available. In locations where data do exist, the number of nesting females is variable. In Sri Lanka, Andaman and Nicobar Islands (India) current nesting populations range from 100 to 600 females annually. Nesting beach populations are far less than that in Thailand, Mozambique, South Africa, and Meru Betiri (Java), where no more than 40 females nest annually at each location. Alas Perwo (Java) appears to be increasing in significance as a nesting beach in the Indian Ocean. The number of eggs recorded annually doubled from 500 to 1000, from the 1980s through the early 2000s (Hamann et al 2006, NMFS and USFWS 2007d).

Populations trends of leatherbacks in the Indian Ocean are difficult to ascertain. Annual fluctuations in the number of nest observed in South Africa over the last 42 years makes it difficult to estimates populations trends for this region. No nesting beach population trends are available for Sri Lanka, Thailand, and Andaman and Nicobar Islands (India). Nesting trends have increased in Alwas Perwo (Java) from the 1980s to the early 2000s, but a declining trend has been seen in Meru Betiri (Java) during the same period. The nesting trend in Mozambique appears stable (Hamann et al 2006, NMFS and USFWS 2007d).

3.2.4.2 Pacific Ocean

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

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

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

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

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

3.2.4.3 Atlantic Ocean

In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS SEFSC 2001). Female leatherbacks nest from the southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are in French Guiana and Suriname (NMFS SEFSC 2001). Previous genetic analyses of leatherbacks using only mitochondrial DNA (mtDNA) resulted in an earlier determination that within the Atlantic basin there are at least three genetically different nesting populations: the St. Croix nesting population (U.S. Virgin Islands), the mainland nesting Caribbean population (Florida, Costa Rica, Suriname/French Guiana), and the Trinidad nesting population (Dutton et al. 1999). Further genetic analyses using microsatellite markers in nuclear DNA along with the mtDNA data and tagging data has resulted in Atlantic Ocean leatherbacks now being divided into seven groups or breeding populations: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG 2007). When the hatchlings leave the nesting beaches, they move offshore but eventually utilize both coastal and pelagic waters. Very little is known about the pelagic habits of the hatchlings and juveniles, and they have not been documented to be associated with the *Sargassum* areas as are other species. Leatherbacks are deep divers, with recorded dives to depths in excess of 1,000 m (Eckert et al. 1989, Hayes et al. 2004).

Life History and Distribution
Leatherbacks are a long-lived species, living for well over 30 years. It has been thought that they reach sexual maturity somewhat faster than other sea turtles (except Kemp's ridley), with an estimated range from 3-6 years (Rhodin 1985) to 13-14 years (Zug and Parham 1996). However, some recent research using sophisticated methods of analyzing leatherback ossicles has cast doubt on the previously accepted age to maturity figures, with leatherbacks in the western North Atlantic possibly not reaching sexual maturity until as late as 29 years of age (Avens and Goshe 2007). Continued research in this area is vitally important to understanding the life history of leatherbacks and has important implications in management of the species.

Female leatherbacks nest frequently (up to 10 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and, thus, can produce 700 eggs or more per nesting season (Schultz 1975).

However, a significant portion (up to approximately 30 percent) of the eggs can be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. The eggs incubate for 55-75 days before hatching. Based on a review of all sightings of leatherback sea turtles of <145 cm curved carapace length (ccl), Eckert (1999) found that leatherback juveniles remain in waters warmer than 26°C until they exceed 100 ccl.

Although leatherbacks are the most pelagic of the sea turtles, they enter coastal waters on an irregular basis to feed in areas where jellyfish are concentrated. Leatherback sea turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates.

Evidence from tag returns and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between boreal, temperate, and tropical waters (NMFS and USFWS 1992). A 1979 aerial survey of the outer continental shelf from Cape Hatteras, North Carolina, to Cape Sable, Nova Scotia, showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Leatherbacks were sighted in waters where depths ranged from 1 to 4,151 m, but 84.4 percent of sightings were in areas where the water was less than 180 m deep (Shoop and Kenney 1992). Leatherbacks were sighted in waters of a similar sea surface temperature as loggerheads - from 7° to 27.2°C (Shoop and Kenney 1992). However, this species appears to have a greater tolerance for colder waters because more leatherbacks were found at the lower temperatures (Shoop and Kenney 1992). This aerial survey estimated the in-water leatherback population from near Nova Scotia, Canada to Cape Hatteras, North Carolina at approximately 300-600 animals.

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

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

Brazil and Argentina. There is also a small nesting aggregation of leatherbacks in Brazil, and while data are limited to a few satellite tracks, these turtles seem to remain in the southwest Atlantic foraging along the continental shelf margin as far south as Argentina. South African nesting turtles apparently forage primarily south, around the tip of the continent.

Population Dynamics and Status

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

The Southern Caribbean/Guianas stock is the largest known Atlantic leatherback nesting aggregation (TEWG 2007). This area includes the Guianas (Guyana, Suriname, and French Guiana), Trinidad, Dominica, and Venezuela, with the vast majority of the nesting occurring in the Guianas and Trinidad. Past analyses had shown that the nesting aggregation in French Guiana had been declining at about 15 percent per year since 1987 (NMFS SEFSC 2001). However, from 1979-1986, the number of nests was increasing at about 15 percent annually which could mean that the current decline could be part of a nesting cycle which coincides with the erosion cycle of Guiana beaches described by Schultz (1975). It is thought that the cycle of erosion and reformation of beaches has resulted in shifting nesting beaches throughout this region. This was supported by the increased nesting seen in Suriname, where leatherback nest numbers have shown large recent increases concurrent with declines elsewhere (with more than 10,000 nests per year since 1999 and a peak of 30,000 nests in 2001), and the long-term trend for the overall Suriname and French Guiana population was thought to possibly show an increase (Girondot 2002 in Hilterman and Goverse 2003). In the past many sea turtle scientists have agreed that the Guianas (and some would include Trinidad) should be viewed as one population and that a synoptic evaluation of nesting at all beaches in the region is necessary to develop a true picture of population status (Reichart et al. 2001). Genetics studies have added support to this notion and have resulted in the designation of the Southern Caribbean/Guianas stock. Using both Bayesian modeling and regression analyses, the TEWG (2007) determined that the Southern Caribbean/Guianas stock had demonstrated a long-term, positive population growth rate (using nesting females as a proxy for population). This positive growth was seen within major nesting areas for the stock, including Trinidad, Guyana, and the combined beaches of Suriname and French Guiana (TEWG 2007).

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

Nesting data for the Northern Caribbean stock is available from Puerto Rico, the U.S. Virgin Islands (St. Croix), and the British Virgin Islands (Tortola). In Puerto Rico, the primary nesting beaches are at Fajardo and on the island of Culebra. Nesting between 1978 and 2005 has ranged between 469-882 nests, and the population has been growing since 1978, with an overall annual growth rate of 1.1 percent (TEWG 2007). At the primary nesting beach on St. Croix, the Sandy Point National Wildlife Refuge, nesting has fluctuated from a few hundred nests to a high of 1008 in 2001, and the average annual growth rate has been approximately 1.1 percent from 1986-2004 (TEWG 2007). Nesting in Tortola is limited, but has been increasing from 0-6 nests per year in the late 1980s to 35-65 per year in the 2000s, with an annual growth rate of approximately 1.2 percent between 1994 and 2004 (TEWG 2007).

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

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

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

Estimates of total population size for Atlantic leatherbacks are difficult to ascertain due to the inconsistent nature of the available nesting data. In 1996, the entire western Atlantic population was characterized as stable at best (Spotila et al. 1996), with numbers of nesting females reported to be on the order of 18,800. A subsequent analysis by Spotila (pers. comm.) indicated that by 2000, the western Atlantic nesting population had decreased to about 15,000 nesting females. Spotila et al. (1996) estimated that the leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, totaled approximately 27,600 nesting females, with an estimated range of 20,082-35,133. This is consistent with the estimate of 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) determined by the TEWG (2007).

Threats

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

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

Leatherbacks are exposed to pelagic longline fisheries in many areas of their range. Unlike loggerhead turtle interactions with longline gear, leatherback turtles do not usually ingest longline bait. Instead, leatherbacks are typically foul-hooked by longline gear (e.g., on the flipper or shoulder area) rather than getting mouth-hooked or swallowing the hook (NMFS SEFSC 2001). A total of 24 nations, including the United States (accounting for 5-8 percent of the hooks fished), have fleets participating in pelagic longline fisheries in the area. Basin-wide, Lewison et al. (2004) estimated that 30,000-60,000 leatherback sea turtle captures occurred in Atlantic pelagic longline fisheries in the year 2000 alone (note that multiple captures of the same individual are known to occur, so the actual number of individuals captured may not be as high). Genetic studies performed within the Northeast Distant Fishery Experiment indicate that the leatherbacks captured in the Atlantic highly migratory species pelagic longline fishery were primarily from the French Guiana and Trinidad nesting stocks (over 95 percent); individuals from West African stocks were surprisingly absent (Roden et al. in press).

Leatherbacks are also susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer et al. 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer et al.

2002). Fixed gear fisheries in the mid-Atlantic have also contributed to leatherback entanglements. In North Carolina, two leatherback sea turtles were reported entangled in a crab pot buoy inside Hatteras Inlet (D. Fletcher, pers. comm. to S. Epperly in NMFS SEFSC 2001). A third leatherback was reported entangled in a crab pot buoy in Pamlico Sound near Ocracoke. This turtle was disentangled and released alive; however, lacerations on the front flippers from the lines were evident (D. Fletcher, pers. comm. to S. Epperly in NMFS SEFSC 2001). In the Southeast, leatherbacks are vulnerable to entanglement in Florida's lobster pot and stone crab fisheries. In the U.S. Virgin Islands, where one of five leatherback strandings from 1982 to 1997 was due to entanglement (Boulon 2000), leatherbacks have been observed with their flippers wrapped in the line of West Indian fish traps (R. Boulon, pers. comm. to J. Braun-McNeill in NMFS SEFSC 2001). Because many entanglements of this typically pelagic species likely go unnoticed, entanglements in fishing gear may be much higher.

Leatherback interactions with the southeast Atlantic shrimp fishery, which operates predominately from North Carolina through southeast Florida (NMFS 2002a), have also been a common occurrence. Leatherbacks, which migrate north annually, are likely to encounter shrimp trawls working in the coastal waters off the Atlantic coast from Cape Canaveral, Florida, to the Virginia/North Carolina border. Leatherbacks also interact with the Gulf of Mexico shrimp fishery. For many years, TEDs required for use in these fisheries were less effective at excluding leatherbacks than the smaller, hard-shelled turtle species. To address this problem, on February 21, 2003, the NMFS issued a final rule to amend the TED regulations. Modifications to the design of TEDs are now required in order to exclude leatherbacks and large and sexually mature loggerhead and green turtles.

Other trawl fisheries are also known to interact with leatherback sea turtles. In October 2001, a Northeast Fisheries Science Center (NEFSC) observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off of Delaware; TEDs are not required in this fishery. The winter trawl flounder fishery, which did not come under the revised TED regulations, may also interact with leatherback sea turtles.

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

Poaching is not known to be a problem for nesting populations in the continental United States. However, in 2001 the NMFS Southeast Fishery Science Center (SEFSC) noted that poaching of juveniles and adults was still occurring in the U.S. Virgin Islands and the Guianas. In all, four of the five strandings in St. Croix were the result of poaching (Boulon 2000). A few cases of fishermen poaching leatherbacks have been reported from Puerto Rico, but most of the poaching is on eggs.

Leatherback sea turtles may be more susceptible to marine debris ingestion than other species due to their pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding areas and migratory routes (Lutcavage et al. 1997, Shoop and Kenney 1992). Investigations of the stomach contents of leatherback sea turtles revealed that a substantial percentage (44 percent of the 16 cases examined) contained plastic (Mrosovsky 1981). Along the coast of Peru, intestinal contents of 19 of 140 (13 percent) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that the object might resemble a food item by its shape, color, size or even movement as it drifts about, and induce a feeding response in leatherbacks.

It is important to note that, like marine debris, fishing gear interactions and poaching are problems for leatherbacks throughout their range. Entanglements are common in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line and crab pot line. Leatherbacks are reported taken by many other nations that participate in Atlantic pelagic longline fisheries, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, U.K., Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland (see NMFS SEFSC 2001, for a description of take records). Leatherbacks are known to drown in fish nets set in coastal waters of Sao Tome, West Africa (Castroviejo et al. 1994, Graff 1995). Gillnets are one of the suspected causes of the decline in the leatherback sea turtle population in French Guiana (Chevalier et al. 1999), and gillnets targeting green and hawksbill turtles in the waters of coastal Nicaragua also incidentally catch leatherback turtles (Lageux et al. 1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio-M. 2000). A study by the Trinidad and Tobago's Institute for Marine Affairs (IMA) in 2002 confirmed that bycatch of leatherbacks is high in Trinidad. IMA estimated that more than 3,000 leatherbacks were captured incidental to gillnet fishing in the coastal waters of Trinidad in 2000. As much as one half or more of the gravid turtles in Trinidad and Tobago waters may be killed (Lee Lum 2003). However, many of the turtles do not die as a result of drowning, but rather because the fishermen butcher them in order to get them out of their nets (NMFS SEFSC 2001).

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

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

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

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

3.2.4.4 Summary of Leatherback Status

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

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

3.2.5 Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. It was listed because of direct take, incidental capture in various fisheries, and the alteration and destruction of its habitat. Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. The majority of loggerhead nesting occurs in the western Atlantic Ocean (south Florida, United States), and the western Indian Ocean (Masirah, Oman); in both locations nesting assemblages have more than 10,000 females nesting each year (NMFS and USFWS 2008). Loggerhead sea turtles are the most abundant species of sea turtle in U.S. waters.

3.2.5.1 Pacific Ocean

In the Pacific Ocean, major loggerhead nesting grounds are generally located in temperate and subtropical regions with scattered nesting in the tropics. Within the Pacific Ocean, loggerhead sea turtles are represented by a northwestern Pacific nesting aggregation (located in Japan) and a smaller southwestern nesting aggregation that occurs in eastern Australia (Great Barrier Reef and Queensland) and New Caledonia (NMFS SEFSC 2001). There are no reported loggerhead nesting sites in the eastern or central Pacific Ocean basin. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead sea turtles (Bolten et al. 1996). Information that is more recent suggests that nest numbers have increased somewhat over the period 1998-2004 (NMFS and USFWS 2007e). However, this period is too short to make a determination of the overall trend in nesting (NMFS and USFWS 2007e). Recent genetic analyses on female loggerheads nesting in Japan suggest that this "subpopulation" is comprised of genetically distinct nesting colonies (Hatase et al. 2002) with precise natal homing of individual females. As a result, Hatase et al. (2002) indicate that loss of one of these colonies would decrease the genetic diversity of Japanese loggerheads; recolonization of the site would not be expected on an ecological time scale. In Australia, long-term census data have been collected at some rookeries since the late 1960s and early 1970s, and nearly all the data show marked declines in nesting populations since the mid-1980s (Limpus and Limpus 2003). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

Pacific loggerhead turtles are captured, injured, or killed in numerous Pacific fisheries including Japanese longline fisheries in the western Pacific Ocean and South China Seas; direct harvest and commercial fisheries off Baja California, Mexico; commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet

fisheries. In Australia, where turtles are taken in bottom trawl and longline fisheries, efforts have been made to reduce fishery bycatch (NMFS and USFWS 2007e).
In addition, the abundance of loggerhead sea turtles in nesting colonies throughout the Pacific basin has declined dramatically over the past 10 to 20 years. Loggerhead turtle colonies in the western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females and reduced the reproductive success of females that manage to nest (e.g., due to egg poaching).

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

3.2.5.2 Indian Ocean

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

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

3.2.5.3 Mediterranean Sea

Nesting in the Mediterranean is confined almost exclusively to the eastern basin. The highest level of nesting in the Mediterranean occurs in Greece, with an average of 3,050 nests per year. There is a long history of exploitation of loggerheads in the Mediterranean. Although much of this is now prohibited, some directed take still occurs.

Loggerheads in the Mediterranean also face the threat of habitat degradation, incidental fishery interactions, vessel strikes, and marine pollution (Margaritoulis et al. 2003). Longline fisheries, in particular, are believed to catch thousands of juvenile loggerheads each year (NMFS and USFWS 2007e), although genetic analyses indicate that only a portion of the loggerheads captured originate from nesting groups in the Mediterranean (Laurent et al. 1998). A thorough review by the Loggerhead Turtle Biological Review Team determined that Mediterranean loggerheads could comprise a separate DPS, denoted the Mediterranean Sea DPS (Conant et al. 2009).

3.2.5.4 Atlantic Ocean

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. Previous section 7 analyses have recognized at least five western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29°N; (2) a south Florida nesting subpopulation, occurring from 29°N on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez 1990 and TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS SEFSC 2001). The recently published Recovery Plan for the northwest Atlantic population of loggerhead sea turtles concluded, based on recent advances in genetic analyses, that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula, and that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the Plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are: the (1) Northern Recovery Unit (Florida/Georgia border north through southern Virginia); (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida); (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida); (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas); and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 2008). The Recovery Plan concluded that all recovery units are essential to the recovery of the species. The Loggerhead Biological Review Team determined that loggerhead turtles in the Atlantic meet the required characteristics for listing as three separate DPSs, the Northwest Atlantic DPS, Northeast Atlantic DPS, and South Atlantic DPS (Conant et al. 2009).

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

Mating takes place in late March-early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern United States. Individual females nest multiple times during a nesting season, with a mean of 4.1 nests per individual (Murphy and Hopkins 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2-3 years, but can vary from 1-7 years (Dodd 1988). Generally, loggerhead sea turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7-12 years or more. Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length, they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico, although some loggerheads may move back and forth between the pelagic and benthic environment (Witzell 2002). Benthic immature loggerheads (sea turtles that have come back to inshore and nearshore waters), the life stage following the pelagic immature stage, have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in northeastern Mexico.

Tagging studies have shown loggerheads that have entered the benthic environment undertake routine migrations along the coast that are limited by seasonal water temperatures. Loggerhead sea turtles occur year-round in offshore waters off North Carolina where water temperature is influenced by the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to immigrate to North Carolina inshore waters (e.g., Pamlico and Core Sounds) and also move up the coast (Epperly et al. 1995a-c), occurring in Virginia foraging areas as early as April and on the most northern foraging grounds in the Gulf of Maine in June. The trend is reversed in the fall as water temperatures cool. The large majority of loggerheads leave the Gulf of Maine by mid-September but some may remain in mid-Atlantic and Northeast areas until late fall. By December, loggerheads have emigrated from inshore North Carolina waters and coastal waters to the north to waters offshore of North Carolina, particularly off of Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles ($\geq$11°C) (Epperly et al. 1995a-c). Loggerhead sea turtles are year-round residents of central and south Florida.

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

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

Population Dynamics and Status

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

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

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

Another consideration that may add to the importance and vulnerability of the NRU is the sex ratios of this subpopulation. NMFS scientists have estimated that the Northern subpopulation produces 65 percent males (NMFS SEFSC 2001). However, research conducted over a limited period has found opposing sex ratios (Wyneken et al. 2004), so further information is needed to clarify the issue. Since nesting female loggerhead sea turtles exhibit nest fidelity, the continued existence of the Northern subpopulation is related to the number of female hatchlings that are produced. Producing fewer females will limit the number of subsequent offspring produced by the subpopulation.

The Peninsular Florida Recovery Unit (PFRU) is the largest loggerhead nesting assemblage in the northwest Atlantic. A near-complete nest census undertaken from 1989 to 2007 showed a mean of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (from NMFS and USFWS 2008). An analysis of index nesting beach data shows a decline in nesting by the PFRU between 1989 and 2008 of 26 percent over the period, and a mean annual rate of decline of 1.6 percent (Witherington et al. 2009, NMFS and USFWS 2008).

The remaining three recovery units—the 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 has been relatively stable during the 9-year period from 1995-2004 (although the 2002 year was missed). Nest counts ranged from 168-270, with a mean of 246, but with no detectable trend during this period (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide Nesting Beach Survey Data; NMFS and USFWS 2008). Nest counts for the NGMRU are focused on index beaches rather than all beaches where nesting occurs. The 12-year dataset (1997-2008) of index nesting beaches in the area shows a significant declining trend of 4.7 percent annually (NMFS and USFWS 2008). Similarly, nesting survey effort has been inconsistent among the GCRU nesting beaches and no trend can be determined for this subpopulation. Zurita et al. (2003) found a statistically significant increase in the number of nests on seven of the beaches on Quintana Roo, Mexico, from 1987-2001, where survey effort was consistent during the period. However, nesting has declined since 2001 and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008)

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

The NMFS Southeast Fishery Science Center has developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS SEFSC 2009). This model does not incorporate existing trends in the data (such as nesting trends), but relies on utilizing the available information on the relevant life-history parameters for sea turtles and then predicts future population trajectories based upon model runs using those parameters. Therefore, the model results do not build upon, but instead are complementary to, the trend data obtained through nest counts and other observations. The model uses the range of published information for the various parameters including mortality by stage, stage duration (years in a stage), and fecundity parameters such as eggs per nest, nests per nesting female, hatchling emergence success, sex ratio, and remigration interval. Model runs were done for each individual recovery unit as well as the western North Atlantic population as a whole, and the resulting trajectories were found to be very similar. One of the most robust results from the model was an estimate of the adult female population size for the western North Atlantic over the 2004-2008 period. The distribution resulting from the model runs suggest the adult female population size to be likely between approximately 20,000 to 40,000 individuals, with a low likelihood of being up to 70,000. A much less robust estimate for total benthic females in the western North Atlantic ranged from approximately 30,000-300,000 individuals, up to less than 1 million.

The results of one set of model runs suggest that the population is most likely declining, but this result was very sensitive to the choice of the position of the parameters within their range and hypothesized distributions. This example was run to predict the distribution of projected population trajectories for benthic females using a range of starting population numbers from the estimated minimum of 30,000 to the greater than

300,000 upper end of the range and declining trajectories were estimated for all of the population estimates. After 10,000 simulation runs of the models using the parameter ranges, 14 percent of the runs resulted in growing populations, while 86 percent resulted in declining populations. While this does not translate to an equivalent statement that there is an 86 percent chance of a declining population, it does illustrate that given the life history parameter information currently thought to comprise the likely range of possibilities, it appears most likely that with no changes to those parameters the population is projected to decline. Additional model runs using the range of values for each life history parameter, the assumption of non-uniform distribution for those parameters, and a 5 percent natural (non-anthropogenic) mortality for the benthic stages, resulted in a determination that a 60-70 percent reduction in anthropogenic mortality in the benthic stages would be needed to bring 50 percent of the model runs to a static (zero growth or decline) or increasing trajectory (NMFS SEFSC 2009).

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

Threats

The 5-year status review of loggerhead sea turtles recently completed by NMFS and the USFWS provides a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and USFWS 2007e). The Loggerhead Recovery Team also undertook a comprehensive evaluation of threats to the species, and described them separately for the terrestrial, neritic, and oceanic zones (NMFS and USFWS 2008). The diversity of sea turtles' life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the benthic environment, and in the pelagic

Loggerheads may also be facing a new threat that could be either natural or anthropogenic. A little understood disease may pose a new threat to loggerheads sea turtles. From October 5, 2000, to March 24, 2001, 49 debilitated loggerheads associated with the disease were found in southern Florida from Manatee County on the west coast through Brevard County on the east coast (Foley 2002). From the onset of the epizootic through its conclusion, affected sea turtles were found throughout south Florida. Most (N=34) were found in the Florida Keys (Monroe County). The number of dead or debilitated loggerheads found during the epizootic (N=189) was almost six times greater than the average number found in south Florida from October to March during the previous ten years. After determining that no other unusual mortality factors appeared to have been operating during the epizootic, 156 of the strandings were likely to be attributed to disease outbreak. These numbers may represent only 10 to 20 percent of the sea turtles that were affected by this disease because many dead or dying sea turtles likely never wash ashore. Overall mortality associated with the epizootic was estimated between 156 and 2,229 loggerheads (Foley 2002). Scientists were unable to attribute the illness and epidemic to any one specific pathogen or toxin. If the agent responsible for debilitating these sea turtles re-emerges in Florida, and if the agent is infectious, nesting females could spread the disease throughout the range of the adult loggerhead population.

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

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

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

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

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

Actions have been taken to reduce anthropogenic impacts to loggerhead sea turtles from various sources, particularly since the early 1990s. These include lighting ordinances, predation control, and nest relocations to help increase hatchling survival, as well as measures to reduce the mortality of pelagic immatures, benthic immatures, and sexually mature age classes in various fisheries and other marine activities. Recent actions have taken significant steps towards reducing the environmental baseline and improving the status of all loggerhead subpopulations. For example, the TED regulation published on February 21, 2003, (68 FR 8456) represents a significant improvement in the baseline affecting loggerhead sea turtles. Shrimp trawling is considered the largest source of anthropogenic mortality on loggerheads.

3.2.5.5 Summary of Status for Loggerhead Sea Turtles

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

In the Atlantic Ocean, absolute population size is not known, but based on extrapolation of nesting information, loggerheads are likely much more numerous than in the Pacific Ocean. The NMFS recognizes five recovery units of loggerhead sea turtles in the western north Atlantic based on genetic studies and management regimes. Cohorts from all of these are known to occur within the action area of this consultation. There are long-term declining nesting trends for the two largest western Atlantic recovery units: the PFRU and the NRU. Furthermore, no long-term data suggest any of the loggerhead subpopulations throughout the entire North Atlantic are increasing in annual numbers of nests (TEWG 2009). Additionally, using both computation of susceptibility to quasi-extinction and stage-based deterministic modeling to determine the effects of known threats to the Northwest Atlantic DPS, the Loggerhead Biological Review Team determined that this DPS is likely to decline in the foreseeable future, driven primarily by the mortality of juvenile and adult loggerheads from fishery bycatch throughout the North Atlantic Ocean. These computations were done for each of the recovery units, and all of them resulted in an expected decline (Conant et al. 2009). Because of its size, the PFRU may be critical to the survival of the species in the Atlantic Ocean. In the past, this nesting aggregation was considered second in size only to the nesting aggregation on islands in the Arabian Sea off Oman (Ross 1979, Ehrhart 1989, NMFS and USFWS 1991b). However, the status of the Oman colony has not been evaluated recently and it is located in an area of the world where it is highly vulnerable to disruptive events such as political upheavals, wars, catastrophic oil spills, and lack of strong protections for sea turtles (Meylan et al. 1995). Given the lack of updated information on this population, the status of loggerheads in the Indian Ocean basin overall is essentially unknown. On March 5, 2008, NMFS and USFWS published a 90-day finding that a petitioned request to reclassify loggerhead turtles in the western North Atlantic Ocean as a distinct population segment may be warranted (73 FR 11849). NMFS and USFWS have formed a biological review team to assess the data and determined that loggerhead sea turtles in the Atlantic meet the required characteristics to be separated into three DPSs, the Northwest Atlantic DPS, Northeast Atlantic DPS, and South Atlantic DPS (Conant et al. 2009). NMFS and USFWS will use the information in that review, along with other available information, to determine the listing status (threatened or endangered) for each DPS.

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

3.2.6 Smalltooth Sawfish

The U.S. smalltooth sawfish distinct population segment (DPS) was listed as endangered under the ESA on April 1, 2003 (68 FR 15674). The smalltooth sawfish is the first marine fish to be listed in the United States. On November 20, 2008, NMFS proposed to designate critical habitat for smalltooth sawfish (73 FR 70290). The proposed critical habitat would comprise of two units off southwestern Florida – the Charlotte Harbor Estuary and the Ten Thousand Island/Everglades unit – comprising approximately 619,013 acres. Historically, smalltooth sawfish occurred commonly in the inshore waters of the Gulf of Mexico and the U.S. Eastern Seaboard up to North Carolina, and more rarely as far north as New York. Based on smalltooth sawfish encounter data, the current core range for the smalltooth sawfish is currently from the Caloosahatchee River to Florida Bay (Simpfendorfer and Wiley 2004).

All extant sawfish belong to the Suborder Pristoidea, Family Pristidae, and Genus Pristis. Although they are rays, sawfish appear to more resemble sharks, with only the trunk and especially the head ventrally flattened. Smalltooth sawfish are characterized by their "saw," a long, narrow, flattened rostral blade with a series of transverse teeth along either edge.

Life History and Distribution
Life history information on smalltooth sawfish is limited. Small amounts of data exist in old taxonomic works and occurrence notes (e.g., Breder 1952, Bigelow and Schroeder 1953, Wallace 1967, Thorson et al. 1966). However, as Simpfendorfer and Wiley (2004) note, these relate primarily to occurrence and size. Recent research and sawfish public encounter information is now providing new data and hypotheses about smalltooth sawfish life history (e.g., Simpfendorfer 2001 and 2003, Seitz and Poulakis 2002, Poulakis and Seitz 2004, Simpfendorfer and Wiley 2004), but more data are still needed to confirm many of these new hypotheses.

As in all elasmobranchs, fertilization is internal. Bigelow and Schroeder (1953) report the litter size as 15 to 20. Simpfendorfer and Wiley (2004) however, caution that this may be an overestimate, with recent anecdotal information suggesting smaller litter sizes (~10). Smalltooth sawfish mating and pupping seasons, gestation, and reproductive periodicity are all unknown. Gestation and reproductive periodicity, however, may be inferred based on that of the largetooth sawfish, sharing the same genus and having similarities in size and habitat. Thorson (1976) reported the gestation period for largetooth sawfish was approximately five months and concluded that females probably produce litters every second year.

Bigelow and Schroeder (1953) describe smalltooth sawfish as generally about two feet long (61 cm) at birth and growing to a length of 18 feet (549 cm) or greater. Recent data from smalltooth sawfish caught off Florida, however, demonstrate young are born at 75-85 cm , with males reaching maturity at approximately 270 cm and females at approximately 360 cm (Simpfendorfer 2002, Simpfendorfer and Wiley 2004). The maximum reported size of a smalltooth sawfish is 760 cm (Last and Stevens 1994), but the maximum size normally observed is 600 cm (Adams and Wilson 1995). No formal studies on the age and growth of the smalltooth sawfish have been conducted to date, but Simpfendorfer (2000) estimates the age of maturity for these species at 10-20 years, with a maximum age of 30 to 60 years. These characteristics suggest very a low intrinsic rate of increase (Simpfendorfer 2000).

Smalltooth sawfish feed primarily on fish, with mullet, jacks, and ladyfish believed to be their primary food resources (Simpfendorfer 2001). By moving its saw rapidly from side to side through the water, the relatively slow moving sawfish is able to strike at individual fish (Breder 1952). The teeth on the saw stun, impale, injure, or kill the fish. Smalltooth sawfish then rub their saw against bottom substrate to remove the fish, which are then eaten. In addition to fish, smalltooth sawfish also prey on crustaceans (mostly shrimp and crabs), which are located by disturbing bottom sediment with their saw (Norman and Fraser 1938, Bigelow and Schroeder 1953).

Smalltooth sawfish are euryhaline, occurring in waters with a broad range of salinities from freshwater to full seawater (Simpfendorfer 2001). Their occurrence in freshwater is suspected to be only in estuarine areas temporarily freshwater from receiving high levels of freshwater input. Many encounters are reported at the mouths of rivers or other sources of freshwater inflows, suggesting estuarine areas may be an important factor in the species distribution (Simpfendorfer and Wiley 2004).

The literature indicates that smalltooth sawfish are most common in shallow coastal waters less than 25 m (Bigelow and Schroeder 1953, Adams and Wilson 1995). Indeed, the distribution of the smallest size classes of smalltooth sawfish indicate that nursery areas occur throughout Florida in areas of shallow water, close to shore and typically associated with mangroves (Simpfendorfer and Wiley 2004). However, encounter data indicate there is a tendency for smalltooth sawfish to move offshore and into deeper water as they grow. An examination of the relationship between the depth at which sawfish occur and their estimated size indicates that larger animals are more likely to be found in deeper waters. Since large animals are also observed in very shallow waters, it is believed that smaller (younger) animals are restricted to shallow waters, while large animals roam over a much larger depth range (Simpfendorfer 2001). Mature animals are known to occur in water depths of 100 m or more (C. Simpfendorfer pers. comm. 2006).

Data collected by Mote Marine Laboratory indicate smalltooth sawfish occur over a range of temperatures but appear to prefer water temperatures greater than 64.4°F (18°C) (Simpfendorfer 2001). The data also suggest that smalltooth sawfish may utilize warm water outflows of power stations as thermal refuges during colder months to enhance their survival or become trapped by surrounding cold water from which they would normally migrate. Almost all occurrences of smalltooth sawfish in warm water outflows were during the coldest part of the year, when water temperatures in these outfalls are typically well above ambient temperatures. Further study of the importance of thermal refuges to smalltooth sawfish is needed. Significant use of these areas by sawfish may disrupt their normal migratory patterns (Simpfendorfer and Wiley 2004).

Smalltooth sawfish historically occurred commonly in the shallow waters of the Gulf of Mexico and along the eastern seaboard as far north as North Carolina, with rare records of occurrence as far north as New York. The smalltooth sawfish range has subsequently contracted to predominantly peninsular Florida and, within that area, they can only be found with any regularity off the extreme southern portion of the state. Historic records of smalltooth sawfish indicate that some large mature individuals migrate north along the U.S. Atlantic coast as temperatures warmed in the summer and then south as temperatures cooled (Bigelow and Schroeder 1953). However, recent Florida encounter data do not suggest such migration. One smalltooth sawfish has been recorded north of Florida since 1963 - captured off of Georgia in July 2000 - but it is unknown whether this individual resided in Georgia waters annually or had migrated north from Florida. Given the very limited number of encounter reports from the east coast of Florida, Simpfendorfer and Wiley (2004) hypothesize the population previously undertaking the summer migration has declined to a point where the migration is undetectable or does not occur. NMFS observers have been collecting data in the Atlantic longline fishery since 1992 and have no documented interactions between the HMS pelagic longline fishery and smalltooth sawfish, which provides some additional support to these range estimates. Further research focusing on states north of Florida or using satellite telemetry is needed to test this hypothesis.

Population Dynamics, Status and Trends

Despite being widely recognized as common throughout their historic range up until the middle of the 20th century, the smalltooth sawfish population declined dramatically during the middle and later parts of the century. The decline in the population of smalltooth sawfish is attributed to fishing (both commercial and recreational), habitat modification, and sawfish life history. Large numbers of smalltooth sawfish were caught as bycatch in the early part of this century. Smalltooth sawfish were historically caught as bycatch in various fishing gears throughout their historic range, including gillnet, otter trawl, trammel net, seine, and to a lesser degree, handline. Frequent accounts in earlier literature document smalltooth sawfish being entangled in fishing nets from areas where smalltooth sawfish were once common but are now rare (Everman and Bean 1898). Loss and degradation of habitat contributed to the decline of many marine species and is expected to have impacted the distribution and abundance of smalltooth sawfish.

Estimates of the magnitude of the decline in the smalltooth sawfish are difficult to make. Because of the species' limited importance in commercial and recreational fisheries and its large size and toothed rostrum, making it difficult to handle, it was not well studied before incidental bycatch severely reduced its numbers. However, based on the contraction of the species' range, and other anecdotal data, Simpfendorfer (2001) estimated that the United States population size is currently less than 5 percent of its size at the time of European settlement.

Seitz and Poulakis (2002) and Poulakis and Seitz (2004) document occurrences of sawfish from 1990 to 2002 along the southwest coast of Florida, and in Florida Bay and the Florida Keys, respectively. The information was collected by soliciting information from anyone who would possibly encounter these fish via posters displaying an image of a sawfish and requesting anyone with information on these fish since 1990 to contact the authors. Posters were distributed beginning in January 1999 and continue to be maintained from Charlotte County to Monroe County in places where anglers and boaters would likely encounter them (e.g., bait and tackle shops, boat ramps, fishing tournaments). In addition to circulating posters, information was obtained by contacting other fishery biologists, fishing guides, guide associations, gun clubs, recreational and commercial fishers, scuba divers, mosquito control districts, and newspapers. The total number of sawfish in the combined study areas of both publications is 2,620. By November 2005, a total of 989 interviews had documented 3,289 smalltooth sawfish encounters in U.S. waters, the majority occurring in South Florida since 1998 (Seitz and Poulakis 2006). As of March 2008, a total of 1,440 interviews documented 3,395 smalltooth sawfish encounters in U.S. waters, the majority occurring in South Florida since 1998 (Seitz and Poulakis 2006, G. Poulakis pers. comm. 2008).

The Florida Fish and Wildlife Conservation Commission has also conducted research collections for smalltooth sawfish. From February 2005 through March 2008, they collected 65 juvenile smalltooth sawfish, primarily from the Caloosahatchee River. This research is currently on-going (G. Poulakis pers. comm. 2008).

Mote Marine Laboratory also maintains a smalltooth sawfish public encounter database, established in 2000 to compile information on the distribution and abundance of sawfish. Encounter records are collected using some of the same outreach tactics as above in Florida statewide. To ensure the requests for information are spread evenly throughout the state, awareness-raising activities were divided into six regions and focused in each region on a biannual basis between May 2002 and May 2004. Prior to 2002, awareness raising activities were organized on an ad-hoc basis because of limited resources. The records in the database extend back to the 1950s, but are mostly from 1998 to the present. The data are validated using a variety of methods (photographs, video, directed questions). As of February 29, 2006, a total of 958 verified sawfish encounters have been reported since 1998, most from recreational fishers (Mote Marine Laboratory 2008).

The majority of smalltooth sawfish encounters today are from the southwest coast of Florida between the Caloosahatchee River and Florida Bay. Outside of this core area, the smalltooth sawfish appears more common on the west coast of Florida and in the Florida Keys than on the east coast, and occurrences decrease the greater the distance from the core area (Simpfendorfer and Wiley 2004). The capture of a smalltooth sawfish off Georgia in 2003 is the first record north of Florida since 1963. New reports during 2004 extend the current range of the species from Panama City, offshore Louisiana (south of Timbalier Island in 100 ft of water), southern Texas, and the northern coast of Cuba. The Texas sighting was not confirmed to be a smalltooth sawfish so might have been a largetooth sawfish.

There are no data available to estimate the present population size. Although smalltooth sawfish encounter databases may provide a useful future means of measuring changes in the population and its distribution over time, conclusions about the abundance of smalltooth sawfish now cannot be made because outreach efforts and observation effort is not expanded evenly across each study period. Dr. Simpfendorfer reluctantly gives an estimate of 2,000 individuals based on his four years of field experience and data collected from the public, but cautions that actual numbers may be plus or minus at least 50 percent.

Recent encounters with neonates (young of the year), juveniles, and sexually mature sawfish indicate that the population is reproducing (Seitz and Poulakis 2002, Simpfendorfer 2003). The abundance of juveniles encountered, including very small individuals, suggests that the population remains reproductively active and viable (Simpfendorfer and Wiley 2004). Also, the declining numbers of individuals with increasing size is consistent with the historic size composition data (G. Burgess, pers.

comm. in Simpfendorfer and Wiley 2004). This information and recent encounters in new areas beyond the core abundance area suggest that the population may be increasing. However, smalltooth sawfish encounters are still rare along much of their historical range and absent from areas historically abundant such as the Indian River Lagoon and John's Pass (Simpfendorfer and Wiley 2004). With recovery of the species expected to be slow on the basis of the species' life history and other threats to the species remaining (see below), the population's future remains tenuous.

Threats
Smalltooth sawfish are threatened today by the loss of southeastern coastal habitat through such activities as agricultural and urban development, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff. Dredging, canal development, seawall construction, and mangrove clearing have degraded a significant proportion of the coastline. Smalltooth sawfish may be especially vulnerable to coastal habitat degradation due to their affinity to shallow, estuarine systems (NMFS 2000).

Fisheries also still pose a threat to smalltooth sawfish. Although changes over the past decade to U.S. fishing regulations such as Florida's net ban have started to reduce threats to the species over parts of its range, smalltooth sawfish are still occasionally incidentally caught in commercial shrimp trawls, bottom longlines, and recreational rod-and-reel. The current and future abundance of the smalltooth sawfish is limited by its life history characteristics (NMFS 2000). Slow-growing, late-maturing, and long-lived, these combined characteristics result in a very low intrinsic rate of population increase and are associated with the life history strategy known as "k-selection." K-selected animals are usually successful at maintaining relatively small, persistent population sizes in relatively constant environments. Consequently, they are not able to respond effectively (rapidly) to additional and new sources of mortality resulting from changes in their environment (Musick 1999). Simpfendorfer (2000) demonstrated that the life history of this species makes it impossible to sustain any significant level of fishing and makes it slow to recover from any population decline. Thus, the species is susceptible to population decline, even with relatively small increases in mortality.

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

Changes in water temperature as a result of global climate change may affect prey distribution and/or abundance, habitat suitability, and other biological and ecological processes important to smalltooth sawfish. Stochastic events such as hurricanes are also common throughout the range of the smalltooth sawfish, especially in the current core of its range (i.e., south and southwest Florida). The effects global climate change will have on the frequency and/or severity of tropical weather systems, such as hurricanes, is currently being debated. These events are by nature unpredictable and their affect on the smalltooth sawfish are currently unknown.

4.0 Environmental Baseline

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

The environmental baseline for this biological opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered 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, oil and gas exploration, permits allowing take under the ESA, private vessel traffic, and marine pollution.

4.1 Status of Sea Turtles in the Action Area

The five species of sea turtles that occur in the action area are all highly migratory. NMFS believes that no individual members of any of the species are likely to be year-round residents of the action area. Individual animals will make migrations into near shore waters as well as other areas of the North Atlantic Ocean, including the Gulf of Mexico and the Caribbean Sea. Therefore, the status of the five species of sea turtles in the Atlantic (see Section 3) most accurately reflects the species status within the action area.

4.2 Factors Affecting Sea Turtles in the Action Area

In recent years, NMFS has undertaken several section 7 consultations to address the effects of federally permitted fisheries and other federal actions on threatened and endangered sea turtle species, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to minimize the adverse impacts of the action on sea turtles. Similarly, NMFS has undertaken recovery actions under the ESA to address sea turtle takes in the fishing and shipping industries and other activities such as Army Corps of Engineers (COE) dredging operations. The summaries below address anticipated sources of incidental take of sea turtles and include only those federal actions in the Gulf of Mexico EEZ that overlap the stone crab management area, which have already concluded formal section 7 consultation.

4.2.1 Fisheries

Threatened and endangered sea turtles are adversely affected by several types of fishing gears used throughout the action area. Gillnet, longline, other types of hook-and-line gear, trawl gear, and pot fisheries have all been documented as interacting with sea turtles. Available information suggests sea turtles can be captured in any of these gear types when the operation of the gear overlaps with the distribution of sea turtles. For all fisheries for which there is an FMP or for which any federal action is taken to manage that fishery, impacts have been evaluated under section 7. Formal section 7 consultation 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: Atlantic swordfish/tuna/ billfish, Atlantic HMS shark fisheries, coastal migratory pelagic, Gulf of Mexico reef fish, Gulf of Mexico/South Atlantic spiny lobster, South Atlantic snapper-grouper, and Southeast shrimp trawl. An Incidental Take Statement (ITS) has been issued for the take of sea turtles in each of these fisheries (Appendix 1, Table 1a).

Atlantic pelagic fisheries for swordfish, tuna, and billfish are known to incidentally capture large numbers of sea turtles, particularly in the pelagic longline component. Pelagic longline, pelagic driftnet, bottom longline, and/or purse seine gear have all been documented taking sea turtles. NMFS reinitiated consultation on the pelagic longline component of this fishery (NMFS 2004b) as a result of exceeded incidental take levels for loggerheads and leatherbacks sea turtles. The resulting biological opinion stated the long-term continued operation this sector of the fishery was likely to jeopardize the continued existence of leatherback sea turtles, but RPAs were implemented allowing for the continued authorization of the pelagic longline fishing that would not jeopardize leatherback sea turtles.

NMFS has completed a section 7 consultation on the continued authorization of *HMS Atlantic shark fisheries* (NMFS 2008). The commercial fishery uses bottom longline and gillnet gear. The recreational sector of the fishery uses only hook-and-line gear. To protect declining shark stocks the proposed action seeks to greatly reduce the fishing effort in the commercial component of the fishery. These reductions are likely to greatly reduce the interactions between the commercial component of the fishery and sea turtles. The biological opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of any of these species and an ITS was provided.

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 2007c). 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 regions as well, while the recreational sector uses hook-and-line gear. The hook-and-line effort is primarily trolling. The biological opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of any of these species and an ITS was provided.

NMFS recently completed a biological opinion on the *Gulf of Mexico/South Atlantic spiny lobster fishery* (NMFS 2009). The commercial fishery consists of diving, bully net and trapping sectors; recreational fishers are authorized to use bully net and hand-harvest gears. The consultation determined the continued authorization of the fishery would not jeopardize the continued existence of green, hawksbill, Kemp's ridley leatherback, and loggerhead sea turtles. It also presents evidence that the commercial trap sector of the fishery adversely affects these species. An ITS was issued for takes in the commercial trap sector of the fishery.

NMFS completed a section 7 consultation on the continued authorization of the *Gulf of Mexico reef fish fishery* (NMFS 2005a). The fishery uses three basic types of gear: spear and 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 (e.g., handline, bandit gear, rod-and-reel). The biological opinion concluded the fishery was not expected to jeopardize the continued existence of green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. It also concluded only the hook-and-line component of the fishery was likely to adversely affect these species and an ITS was provided.

In 2008, NMFS' Southeast Fisheries Science Center (SEFSC) completed a report on the bycatch of sea turtles in the bottom longline component of the fishery (NMFS SEFSC 2008). The report, based on extrapolated estimates from observed 18 sea turtle takes over 18 months, presented evidence that the take of hardshell turtles had greatly exceeded the level authorized in the previous biological opinion. The majority of observed takes (~90 percent) were identified as loggerheads; size data indicate primarily large juveniles and adults. On September 3, 2008, SERO Sustainable Fishery Division requested reinitiation of section 7 consultation on the fishery. NMFS is currently working with the Gulf of Mexico Fishery Management Council, industry representatives, and environmental groups to identify measures likely to help reduce the severity and frequency of these takes in the future.

A section 7 consultation on the *South Atlantic snapper-grouper fishery* (NMFS 2006a) has also recently been completed by NMFS. The fishery uses spear and powerhead, black sea bass pot, 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 (e.g., handline, bandit gear, rod-and-reel). The consultation 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.

The *Southeast shrimp trawl fishery* affects more sea turtles than all other activities combined (NRC 1990). On December 2, 2002, NMFS completed the biological opinion for shrimp trawling in the southeastern U.S. (NMFS 2002) under proposed revisions to the TED regulations (68 FR 8456, February 21, 2003). This opinion determined that the shrimp trawl fishery under the revised TED regulations would not jeopardize the continued existence of any sea turtle species. This determination was based, in part, on the opinion's analysis that shows the revised TED regulations are expected to reduce shrimp trawl related mortality by 94 percent for loggerheads and 97 percent for leatherbacks. Interactions between sea turtles and the shrimp fishery may also be declining because of reductions of fishing effort unrelated to fisheries management actions. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of recent hurricanes in the Gulf of Mexico have all impacting the shrimp fleets; in some cases reducing fishing effort by as much as 50 percent for offshore waters of the Gulf of Mexico (GMFMC 2007).

4.2.2 Vessel Operations

Potential sources of adverse effects from federal vessel operations in the action area include operations of the U.S. Navy (USN) and Coast Guard (USCG), the Environmental Protection Agency (EPA), the National Oceanic and Atmospheric Administration (NOAA), and the COE. NMFS has conducted formal consultations with the USCG, the USN, and NOAA on their 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. At the present time, however, they present the potential for some level of interaction. Refer to the biological opinions for the USCG (NMFS 1995) and the USN (NMFS 1997) for details on the scope of vessel operations for these agencies and conservation measures being implemented as standard operating procedures.

The USN consultation only covered operations out of Mayport, Florida, and the potential exists for USN vessels to adversely affect sea turtles when they are operating in other areas within the range of these species. Similarly, operations of vessels by other federal agencies within the action area (NOAA, EPA, COE) may adversely affect sea turtles. However, the in-water activities of those agencies are limited in scope, as they operate a limited number of vessels or are engaged in research/operational activities that are unlikely to contribute a large amount of risk.

4.2.3 Additional Military Activities

Additional activities including ordnance detonation, also affect listed species of sea turtles. Section 7 consultations were conducted for USN aerial bombing training in the ocean off the southeast U.S. coast, involving drops of live ordnance (500 and 1,000-lb bombs) (NMFS 1997), and the operation of USCG's boats and cutters in the U.S. Atlantic (NMFS 1995). These consultations determined each activity was likely to adversely affect sea turtles but would not jeopardize their continued existence. An ITS was issued for each activity.

NMFS has also consulted on military training operations conducted by the U.S. Air Force (USAF) and U.S. Marine Corps (USMC). From 1995-2007, three consultations have been completed that evaluated the impacts of ordnance detonation during gunnery training or aerial bombing exercises (NMFS 1998, NMFS 2004c, NMFS 2005b). These consultations determined each activity was likely to adversely affect sea turtles but would not jeopardize their continued existence. An ITS was issued for each activity. A consultation evaluating the impacts from USAF search-and-rescue training operations in the Gulf of Mexico was completed in the 1999 (NMFS 1999). This consultation determined the training operations would adversely affect sea turtles but would not jeopardize their continued existence and an ITS was issued.

4.2.4 Oil and Gas Exploration

COE and MMS authorize oil and gas exploration, well development, production, and abandonment/rig removal activities that may adversely affect sea turtles. Both of these agencies have consulted frequently with NMFS on these types of activities. These activities include the use of seismic arrays for oil and gas exploration in the Gulf of Mexico, the impacts vessel strikes, noise, and marine debris have been analyzed in biological opinions for individual and multi-lease sales.

In July 2004, MMS completed a programmatic environmental assessment (PEA) on geological and geophysical exploration on the Gulf of Mexico Outer Continental Shelf (MMS 2004). The MMS has also completed a PEA on removal and abandonment of offshore structures and effects on protected species in the Gulf of Mexico (MMS 2005).

In 2007, NMFS concluded consultation with the MMS on the effects of a 5-year leasing plan for offshore oil and gas exploration in the Gulf of Mexico (NMFS 2007). The opinion concluded that the proposed action would not jeopardize the continued existence of loggerhead, leatherback, green, hawksbill and Kemp's ridley sea turtles, but was likely to adversely affect them. An ITS for this action was provided.

4.2.5 ESA Permits

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. In addition, section 6 of the ESA allows NMFS to enter into cooperative agreements with states to assist in recovery actions of listed species. Prior to issuance of these permits, the proposal must be reviewed for compliance with section 7 of the ESA.

Sea turtles are the focus of research activities authorized by section 10 permits under the ESA. As of January 2009, there were 21 active scientific research permits directed toward sea turtles that are applicable to the action area of this biological opinion. Authorized activities range from photographing, weighing, and tagging sea turtles incidentally taken in fisheries, to blood sampling, tissue sampling (biopsy), and performing laparoscopy on intentionally captured sea turtles. The number of authorized takes varies widely depending on the research and species involved but may involve the taking of hundreds of sea turtles annually. Most takes authorized under these permits are expected to be non-lethal. Before any research permit is issued, the proposal must be reviewed under the permit regulations (i.e., must show a benefit to the species). In addition, since issuance of the permit is a federal activity, issuance of the permit by NMFS must also undergo a section 7 analysis to ensure the issuance of the permit does not result in jeopardy to the species.

4.2.6 Vessel Traffic

Commercial traffic and recreational pursuits can adversely affect sea turtles through propeller and boat strikes. The Sea Turtle Stranding and Salvage Network (STSSN) includes many records of vessel interaction (propeller injury) with sea turtles off Gulf of Mexico coastal states such as Florida, where there are high levels of vessel traffic. The extent of the problem is difficult to assess because of not knowing whether the majority of sea turtles are struck pre- or post-mortem. Private vessels in the action area participating in high-speed marine events (e.g., boat races) are a particular threat to sea turtles. NMFS and the USCG have completed several formal consultations on individual marine events that may impact sea turtles. NMFS and USCG St. Petersburg Sector are currently conducting a formal consultation regarding high-speed boating events and fishing tournaments occurring off the west coast of Florida that may impact sea turtles.

4.2.7 Marine Pollution

Anthropogenic sources of marine pollution, while difficult to attribute to a specific federal, state, local or private action, may indirectly affect sea turtles in the action area. Sources of pollutants 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. The pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo et al. 1986).

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

4.3 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, Gulf of Mexico reef fish, and TED requirements for Southeast shrimp trawl fishery. In addition to regulations, outreach programs have been established. The summaries below discuss all of these measures in more detail.

4.3.1 Regulations Reducing Threats to Sea Turtles from Fisheries

Reducing Threats from Pelagic Longline and Other Hook-and-Line Fisheries
On May 1, 2009 NMFS published an emergency rule (74 FR 20229), effective from May 18, 2009 through October 28, 2009, prohibiting bottom longlining for Gulf reef fish east of 85°30'W longitude (near Cape San Blas, Florida) and in the portion of the EEZ shoreward of the 50-fathom depth contour. The emergency rule is intended to reduce sea turtle takes in the short-term while the Gulf of Mexico Fishery Management Council develops long-term protective measures through Amendment 31 to the Fishery Management Plan for Reef Fish Resources in the Gulf of Mexico.

NMFS published the final rule to implement sea turtle release gear requirements and sea turtle careful release protocols in the Gulf of Mexico reef fish fishery on August 9, 2006 (71 FR 45428). These measures require owners and operators of vessels with federal commercial or charter vessel/headboat permits for Gulf reef fish to comply with sea turtle (and smalltooth sawfish) release protocols and have on board specific sea turtle release gear. NMFS is currently conducting rulemaking to implement similar release gear and handling requirements for the South Atlantic snapper-grouper fishery.

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

Revised Use of Turtle Excluder Devices in Trawl Fisheries
NMFS has also implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial shrimp trawl fisheries. In particular, NMFS has required the use of TEDs in southeast United States shrimp trawls since 1989 and in summer flounder trawls in the Mid-Atlantic area (south of Cape Charles, Virginia) since 1992. It has been estimated that TEDs exclude 97 percent of the sea turtles caught in such trawls. These regulations have been refined over the years to ensure that TED effectiveness is maximized through proper placement and installation, configuration (e.g., width of bar spacing), floatation, and more widespread use.

Significant measures have been developed to reduce the take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which would include fisheries for other species like scup and black sea bass) by requiring TEDs in trawl nets fished from the North Carolina/South Carolina border to Cape Charles, Virginia. However, the TED requirements for the summer flounder trawl fishery do not require the use of larger TEDs that are used in the shrimp trawl fishery to exclude leatherbacks, as well as large, benthic, immature and sexually mature loggerheads and green sea turtles.

NMFS has also been working to develop a TED, which can be effectively used in a type of trawl known as a flynet, which is sometimes used in the Mid-Atlantic and Northeast fisheries to target sciaenids and bluefish. Limited observer data indicate that takes can be quite high in this fishery. A top-opening flynet TED was certified this summer, but experiments are still ongoing to certify a bottom-opening TED.

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

4.3.2 Other Sea Turtle Conservation Efforts

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.

Outreach and Education, Sea Turtle Entanglements, and Rehabilitation
There is an extensive network of Sea Turtle Stranding and Salvage Network participants along the Atlantic and Gulf of Mexico coasts who not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded sea turtles.

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

Other Actions
A draft revised recovery plan for the loggerhead sea turtle was published May 30, 2008 (73 FR 31066). The recovery plan for the Kemp's ridley sea turtle is in the process of being updated. Recovery teams comprised of sea turtle experts have been convened and are currently working towards revising these plans based upon the latest and best available information. Five-year status reviews have recently been completed for green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. These reviews were conducted to comply with the ESA mandate for periodic status evaluation of listed species to ensure that their threatened or endangered listing status remains accurate. Each review determined that no delisting or reclassification of a species status (i.e., threatened or endangered) was warranted at this time. However, further review of species data for the green, hawksbill, leatherback, and loggerhead sea turtles was recommended, to evaluate whether distinct population segments (DPS) should be established for these species (NMFS and USFWS 2007a-e).

4.4 Factors Affecting Smalltooth Sawfish Within the Action Area

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

4.4.1 Fisheries

NMFS has completed a section 7 consultation on the continued authorization of *HMS Atlantic shark fisheries* (NMFS 2008). The commercial fishery uses bottom longline and gillnet gear. The recreational sector of the fishery uses only hook-and-line gear. To protect declining shark stocks the proposed action seeks to greatly reduce the fishing effort in the commercial component of the fishery. These reductions are likely to greatly reduce the interactions between the commercial component of the fishery and smalltooth sawfish. 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.

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 2007). 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.

NMFS completed a section 7 consultation on the continued authorization of the *Gulf of Mexico reef fish fishery* on February 15, 2005 (NMFS 2005a). The fishery uses three basic types of gear: spear and 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 (e.g., handline, bandit gear, rod-and-reel). The biological opinion concluded that smalltooth sawfish may be adversely affected by the operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of this species and an ITS has been provided.

A section 7 consultation on the *South Atlantic snapper-grouper fishery* completed by NMFS on June 7, 2006 (NMFS 2006a). 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.

NMFS has also conducted section 7 consultations on the impacts of the *Gulf of Mexico shrimp trawl fishery* (NMFS 2006b) *and the South Atlantic shrimp trawl fishery* (NMFS 2005c) on smalltooth sawfish. Both of these consultations found these fisheries likely to adversely affect smalltooth sawfish, but not likely jeopardize their continued existence. The ITS provided in those biological opinions anticipated the lethal take of up to one smalltooth sawfish annually in each of these two fisheries. In May 2009, NMFS requested reinitiation of section 7 consultations on the impacts of the South Atlantic shrimp trawl fishery because the amount of authorized incidental take for smalltooth sawfish had been exceeded. One lethal take was observed in 2008, and three additional takes (one lethal and two non-lethal) were observed in 2009.

Smalltooth sawfish may infrequently be taken in other South Atlantic and Gulf of Mexico federal fisheries involving trawl, gillnet, bottom longline gear, and hook-and-line gear. However, NMFS has little data to substantiate such takings. NMFS is collecting data to analyze the impacts of these fisheries and will conduct section 7 consultations as appropriate.

4.4.2 ESA Permits

Regulations developed under the ESA allow for the issuance of permits allowing take of certain ESA-listed species for scientific research purposes under section 10(a)(1)(A). Prior to issuance of these permits, the proposal must be reviewed for compliance with section 7 of the ESA. There are currently two active smalltooth sawfish research permits.

Permit holders are Dr. John Carlson (SEFSC), and Florida Fish and Wildlife Conservation Commission. Although the permitted research may result in disturbance and injury of smalltooth sawfish, the activities are not expected to affect the reproduction of the individuals that are caught, nor result in mortality.

4.4.3 Conservation and Recovery Actions

Under section 4(f)(1) of the ESA, NMFS is required to develop and implement a recovery plan for the conservation and survival of endangered and threatened species. In September 2003, NMFS convened a smalltooth sawfish recovery team composed of nine members from federal, state, non-governmental, and non-profit organizations. The team has completed a draft recovery plan. The goal of the recovery plan is to rebuild and assure the long-term viability of the U.S. DPS of smalltooth sawfish in the wild, allowing initially for reclassification from endangered to threatened status (downlisting) and ultimately the recovery and subsequent removal from the List of Endangered and Threatened Wildlife (delisting). NMFS released the final Smalltooth Sawfish Recovery Plan on January 21, 2009 (74 FR 3566).

On November 20, 2008, NMFS proposed to designate critical habitat for smalltooth sawfish (73 FR 70290). The proposed critical habitat would comprise of two units off southwestern Florida – the Charlotte Harbor Estuary and the Ten Thousand Island/Everglades unit – comprising approximately 619,013 acres. These areas contain the physical and biological features deemed essential for the conservation of the species.

5.0 Effects of the Action

In this section of the opinion, we assess the probable effects of the continued operation of the Gulf of Mexico stone crab fishery on ESA-listed species. The analysis in this section forms the foundation for our jeopardy (risk) analysis in section 7. A jeopardy determination is reached if we would reasonably expect the proposed action to cause, either directly or indirectly, reductions in numbers, reproduction, or distribution that would appreciably reduce a listed species' likelihood of surviving and recovering in the wild. The ESA defines an endangered species as "...in danger of extinction throughout all or a significant portion of its range..." and a threatened species as "...likely to become an endangered species within the foreseeable future..." The status of each listed species likely to be adversely affected by the continued authorization of the Gulf of Mexico stone crab fishery is reviewed in Section 3. Sea turtle species are listed because of their global status; a jeopardy determination must therefore find the proposed action will appreciably reduce the likelihood of survival and recovery of each species globally. Only the U.S. DPS of smalltooth sawfish is listed; a jeopardy determination must therefore find the proposed action will appreciably reduce the likelihood of survival and recovery of the U.S. DPS.

The analyses in this section are based upon the best available commercial and scientific data on sea turtles and smalltooth sawfish biology and the effects of the proposed action. Data pertaining to the Gulf of Mexico stone crab fishery, relative to interactions with sea turtles and smalltooth sawfish are limited, so we are often forced to make assumptions to overcome the limits in our knowledge. Frequently, different analytical approaches may be applied to the same data sets. In those cases, in keeping with the direction from the U.S. Congress to resolve uncertainty by providing the "benefit of the doubt" to threatened and endangered species [House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)], we will generally select the value yielding the most conservative outcome (i.e., would lead to conclusions of higher, rather than lower, risk to endangered or threatened species).

When analyzing any proposed action, it is important to consider not only its immediate effects to ESA-listed species, but also the effects caused by or resulting from it that are reasonably certain to occur later in time. For example, effects from the proposed action occurring later in time could include habitat degradation, reduction of prey/foraging base, etc. No such effects to sea turtles or smalltooth sawfish have been identified as a result of the operation of the Gulf of Mexico stone crab fishery (i.e., scuba diving, vessel operations, gear deployment and retrieval). Our analysis assumes sea turtles and smalltooth sawfish are not likely to be adversely affected by a gear type unless they interact with it. We also assume the potential effects of each gear type are proportional to the number of interactions between the gear and each species.

Approach to Assessment

Our analysis of the effect of the action in this section involved several steps. We began by determining which gear types/techniques (i.e., hand harvest gears [e.g., nets and snares], and traps) were likely to adversely affect sea turtles and smalltooth sawfish. We then reviewed the range of responses to an individual's exposure to fishing gear and the factors affecting the likelihood of exposure. The focus then shifts to evaluating and quantifying the impacts of stone crab fishing on sea turtles and smalltooth sawfish under status quo management (see Section 2.1 for more detail). For sea turtles and smalltooth sawfish, we estimated the number of individuals likely to be exposed to the fishery, and the likely fate of those animals. We then consider how the fishery's continued operation would affect future levels of take; i.e., whether the estimated past take would increase or decrease and by how much, or whether the same levels would continue in the future.

There are two primary ways stone crab are harvested, by commercial trap/pot and recreational hand harvest and trap/pot gear. Section 2 describes these gears and how recreational or commercial fishermen use them to target stone crab. Since recreational trapping of stone crabs generally occurs very close to shore and in shallow waters (20 ft or less) not under federal jurisdiction, we do not address them in our analysis. However, the remaining types of fishing gears, the areas, and the manner in which they are used, all affect the likelihood of sea turtle or smalltooth sawfish interactions. For this reason, each gear type is evaluated separately.

Due to the stone crab trap limitation program, the number of stone crab trap certificates allocated to the fishery has declined annually following the 2002-2003 fishing season and will not rise again (see Section 2.1). As a result, when discussing the fishery and its interactions with ESA-listed species, we use the data available from the most recent fishing seasons (2005-2006 through 2007-2008) as the baseline to project the number of individuals by species likely to be exposed to the various components of the fishery. We believe data from this time series best reflect the level fishing effort currently occurring in the fishery, and ultimately the level of ESA-listed species interactions occurring under the current management regime.

5.1 Effects on Sea Turtles and Smalltooth Sawfish from Recreational Hand Harvest of Stone Crab

Effects on Sea Turtles and Smalltooth Sawfish
We believe recreational hand harvest of stone crab is not likely to adversely affect sea turtles or smalltooth sawfish. The recreational hand harvest of stone crabs is generally opportunistic while targeting other species (primarily spiny lobster or reef fish). The distribution of these primary target species overlaps spatially with areas known to be inhabited by sea turtles and smalltooth sawfish. However, divers/waders only occasionally encounter sea turtles and rarely encounter smalltooth sawfish, if at all. Anecdotal information from encounters indicates some sea turtles and smalltooth sawfish change their route to avoid coming in close proximity to divers/waders, whereas others appear unaware of their presence. There are no reports of incidental sea turtle or smalltooth sawfish takes by stone crab divers/waders. Given the visual nature of the hunt and capture of stone crab, stone crab divers/waders will easily be able to avoid sea turtles and smalltooth sawfish. Any behavioral effects on sea turtles or smalltooth sawfish from the presence of stone crab divers are expected to be insignificant. We therefore conclude that diving/wading for stone crab is not likely to adversely affect sea turtles or smalltooth sawfish.

5.2 Sea Turtle and Smalltooth Sawfish Interactions with Commercial Stone Crab Trap Gear

5.2.1 Sea Turtle/Trap Interactions

Commercial stone crab traps are known to adversely affect sea turtles via entanglement and forced submergence. Captured sea turtles can be released alive or can be found dead upon retrieval of the gear as a result of forced submergence. Sea turtles released alive may later succumb to injuries sustained at the time of capture. Of the entangled sea turtles that do not die from their wounds, some may suffer impaired swimming or foraging abilities, altered migratory behavior, or altered breeding or reproductive patterns. The following discussion summarizes in greater detail the available information on how individual sea turtles may respond to interactions with stone crab trap gear.

Entanglement
The primary effect on sea turtles from traps is entanglement in buoy lines. Sea turtles are particularly prone to entanglement as a result of their body configuration and behavior. Records of stranded or entangled sea turtles reveal that trap lines can wrap around the neck, flipper, or body of a sea turtle and severely restrict swimming or feeding. If a sea turtle is entangled when young, the line could become tighter and more constricting as

the sea turtle grows, cutting off blood flow and causing deep gashes, some severe enough to remove an appendage.

Loggerhead sea turtles may be particularly vulnerable to entanglement in trap lines because of their attraction to, or attempts to feed on, species caught in the traps and epibonts growing on traps, trap lines, and floats (NMFS and FWS 1991b). Due to body configuration, leatherback sea turtles are also thought to be particularly prone to entanglement.

Forcible Submergence
Sea turtles can be forcibly submerged by trap gear. Forcible submergence may occur through an entanglement event, where the sea turtle is unable to reach the surface to breathe. Forced submergence could also occur if a sea turtle becomes entangled in a trap line below the surface and the line is too short and or the trap is too heavy to be brought up to the surface by the swimming sea turtle.

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

Numerous factors affect the survival rate of forcibly submerged sea turtles. It is likely that the rapidity and extent of the physiological changes that occur during forced submergence are functions of the intensity of struggling, as well as the length of submergence (Lutcavage and Lutz 1997). Other factors influencing the severity of effects from forced submergence include the size, activity level, and condition of the sea turtle; the ambient water temperature, and if multiple forced submergences have recently occurred. Disease factors and hormonal status may also influence survival during forced submergence. Larger sea turtles are capable of longer voluntary dives than small sea turtles, so juveniles may be more vulnerable to the stress from forced submergence. During the warmer months, routine metabolic rates are higher. Increased metabolic rates lead to faster consumption of oxygen stores, which triggers anaerobic glycolysis. Subsequently, the onset of impacts from forced submergence may occur more quickly during these months. With each forced submergence event, lactate levels increase and require a long (up to 20 hours) time to recover to normal levels. Sea turtles are probably more susceptible to lethal metabolic acidosis if they experience multiple forced submergence events in a short period of time. Recurring submergence does not allow sea turtles sufficient time to process lactic acid loads (Lutcavage and Lutz 1997). Stabenau and Vietti (2003) illustrated that sea turtles given time to stabilize their acid-base balance after being forcibly submerged have a higher survival rate. The rate of acid-base stabilization depends on the physiological condition of the turtle (e.g., overall health, age, size), time of last breath, time of submergence, environmental conditions (e.g., sea surface temperature, wave action, etc.), and the nature of any injuries sustained at the time of submergence (NRC 1990).

5.2.2 Smalltooth Sawfish/Trap Interactions

Commercial stone crab traps may adversely affect smalltooth sawfish via entanglement. Entangled smalltooth sawfish may suffer impaired swimming or foraging abilities, altered migratory behavior, and altered breeding or reproductive patterns. The following discussion summarizes the available information on how individual smalltooth sawfish may be impacted by stone crab trap gear.

Entanglement

Entanglement of a smalltooth sawfish's toothed rostrum in a stone crab trap's float line is the primary route of effect between these species and this gear type. While no specific information exists on the effects of stone crab trap entanglement on smalltooth sawfish, Seitz and Poulakis (2006) list chafing and irritation of the skin, as well as the loss of rostral teeth, as consequences of entanglement in other types of marine debris. 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. Entanglement injuries could also impair an animal's ability to swim. All such injuries could affect an individual's growth and reproductive abilities.

5.3 Factors Affecting ESA-Listed Species Interactions with Stone Crab Traps

5.3.1 Gear Characteristics and Fishing Technique

Bait

Traps are baited with bait fish or fish remnants. Mullet, grouper or snapper heads and skeletons, jacks, sharks, and skates or rays are commonly used baits (GMFMC 1979a). Pigs' feet and cowhide have also become common baits in recent years. (Bert et al. 1978). Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hardbottom habitats. As such, loggerhead sea turtles may be attracted to stone crab traps when stone crabs are inside, but the bait is unlikely to attract sea turtles. Loggerheads are also known to feed on epibionts growing on traps, trap lines, and floats and may be attracted to stone crab traps for this reason (NMFS and USFWS 1991b).

There is currently no data available on the attraction of smalltooth sawfish to stone crab trap gear. Data on the feeding behavior of smalltooth sawfish is sparse. Simpfendorfer (2001) reported smalltooth sawfish feed primarily on fish, with mullet, jacks, and ladyfish believed to be their primary food resources. While they feed primarily on live prey, records of smalltooth sawfish taking cut bait also exist. It is unclear if smalltooth sawfish would be attracted to the bait used in stone crab traps.

Spatial/Temporal Overlap Between Fishing Effort and Sea Turtle and Smalltooth Sawfish
Another factor affecting the likelihood of sea turtle and smalltooth sawfish entanglement in stone crab trap gear is the spatial and temporal overlap between where they occur and fishing effort. The spatial distribution of sea turtles and smalltooth sawfish influences the rate of interaction with stone crab traps. The more abundant sea turtles are in a given area where fishing occurs, the greater the probability a sea turtle or smalltooth sawfish will interact with gear. The temporal distribution of fishing effort and sea turtle and smalltooth sawfish abundance is also a factor. Entangled stone crab trap gear was documented in 13 sea turtle strandings in the stone crab management area during 2005-2006 through 2007-2008 fishing seasons. Two were recorded in February, April, and October (46.2 percent of all records) and one was documented each month in January, March, May, June, July, August, and December (53.8 percent of all records). No strandings of sea turtles with stone crab gear entanglements were documented in September or November (NMFS unpublished data).

Soak Time
Stone crab gear interactions with sea turtles and smalltooth sawfish also depend on soak time. The longer the soak time, the longer a sea turtle or smalltooth sawfish is exposed to an entanglement threat, increasing the likelihood of such an event occurring. The mortality rate of entangled sea turtles increases with soak time because of the higher potential for extended forced submergence times. Since forced submergence is not a concern for smalltooth sawfish, soak times do not appear to impact morality rates for incidentally caught animals.

5.3.2 Life Stage

Different life stages of sea turtles and smalltooth sawfish are associated with different habitat types and water depths. For example, pelagic stage loggerheads are found offshore; closely associated with *Sargassum* rafts. As loggerheads mature they begin to live in coastal inshore and nearshore waters foraging over soft- and hardbottom habitats of the continental shelf (Carr 1987, Witzell 2002). Therefore, traps set closer to these areas are more likely to encounter adult loggerheads. Leatherbacks and juvenile loggerheads are more likely to be found further offshore in deeper, colder water. Stone crab traps are generally not fished in these areas, thus the fishery is far less likely to interact with these life stages. Thirteen sea turtle stranding records show evidence of stone crab trap gear entanglements during the 2005-2006 through 2007-2008 fishing seasons: seven loggerheads, one leatherback, one Kemp's ridley, and four unidentified sea turtles. Of those records, size data to estimate animal life stage was available for four animals: one small benthic juvenile loggerhead, two adult loggerheads, and one benthic juvenile Kemp's ridley (NMFS unpublished data). Although genetic samples are collected from sea turtles, the number of samples currently available is too small to be able to determine the sub-population origin of individuals.

Juvenile smalltooth sawfish are most commonly associated with shallow-water areas off Florida, close to shore, and typically associated with mangroves (Simpfendorfer and Wiley 2004). Since large animals are also observed in very shallow waters, it is believed that smaller (younger) animals are restricted to shallow waters, while large animals roam over a much larger depth range (Simpfendorfer 2001). Mature animals are known to occur in water depths of 100 m or more (C. Simpfendorfer pers. comm. 2006). Thus, gear deployed in deeper water is more likely to encounter adult age classes.

5.4 Estimating ESA-Listed Species Take in the Commercial Stone Crab Trap Fishery

The preceding sections discussed the potential adverse effects to sea turtles and smalltooth sawfish that may result from interactions with stone crab trap gear. Our discussion now shifts to evaluating and quantifying the impacts of stone crab trap fishing on those species. In the following sections, we describe the data used, the processes, and the results of our analyses for estimating the number or amount of sea turtle and smalltooth sawfish take that occurred in the commercial stone crab trap fishery from 2005-2006 through 2007-2008.

As noted above (Section 2.2), Florida's Stone Crab Trap Limitation Program has placed a cap on the number of traps available to the fishery since the 2002-03 fishing season. Annual reductions in the number of trap tags[6] available from the FFWCC succeeded in reducing the number of trap tags issued. Since the number of trap tags allocated after the 2002-03 season has been declining our analysis focuses on the fishery during the most recent fishing years for which data are available, the 2005-2006 through 2007-2008. We believe using this period best represents how the fishery operates today and using effort information before this period would introduce a positive bias in the number of traps in use that may overestimate the potential for adverse effects. The cap on number of traps available to the fishery also excludes the possibility of the number of traps in the fishery returning to previous levels. As a result, using data from this time frame will not underestimate effort in the fishery.

5.4.1 Estimating Sea Turtle Take by Commercial Stone Crab Traps

As noted above, sea turtles may be adversely effected by stone crab traps via entanglement and forced submergence. Our analysis used the best available sea turtle entanglement and commercial trap fishery data to estimate the total number of sea turtles taken by the Gulf of Mexico stone crab fishery during the 2005-2006 through 2007-2008 fishing seasons. We calculated a sea turtle take rate per trap soak day and multiplied this figure by the number of soak days estimated for the federal fishery to estimate the number of sea turtles taken. We also estimated the number of mortalities occurring as a result of those takes, and assigned a number of lethal and non-lethal takes to each species. Due to the statistical and mathematical computation used to estimate take and mortality, some of our estimates do not use whole numbers. However, because it is impossible to

[6] Trap tags are required and must be attached to each individual stone crab trap fished. As a result, trap tags are a reasonable surrogate for estimating the actual number of traps fished. It is possible for a trap tag to be purchased but never actually used. To act conservatively, our analysis assumes all trap tags issued represent actual traps used in the fishery.

take only a portion of a sea turtle or smalltooth sawfish, our final take estimates were rounded.

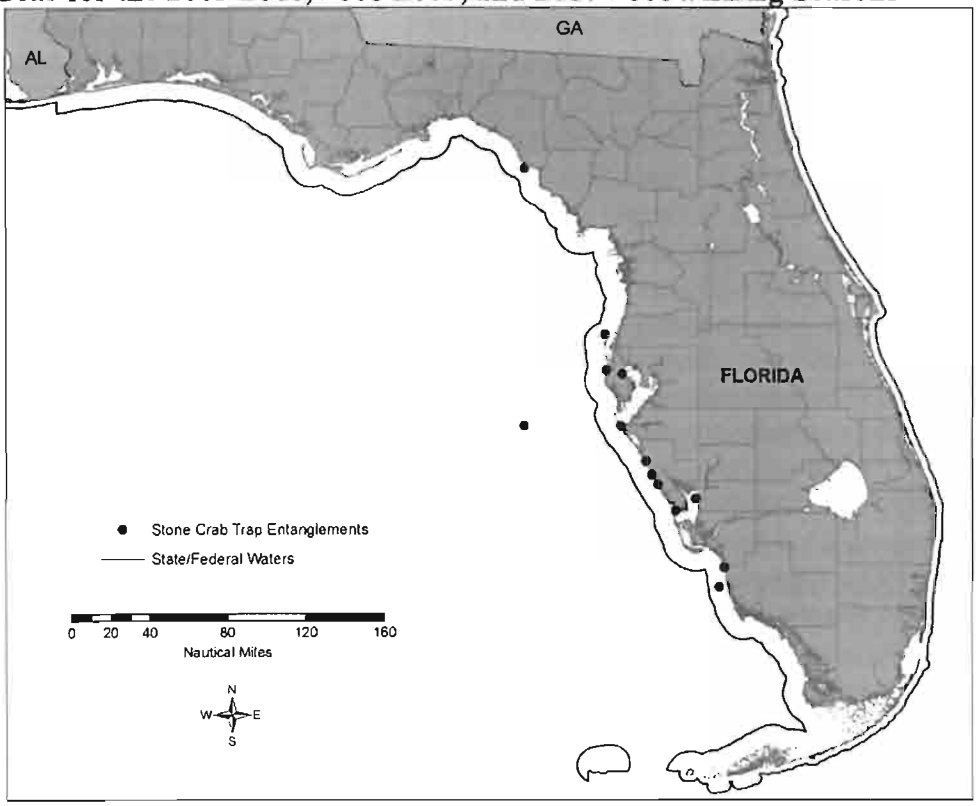
To calculate the sea turtle take rate,we used all STSSN stranding and incidental capture records (from both state and federal waters) documented during the 2005-2006 through 2007-2008 fishing seasons to increase our sample size (see the following section for more details on those data). We believe this approach is sensible for a number of reasons. Trap construction requirements are very similar in the state and federal fisheries, and the fishing season is the same. The species of sea turtles that occur in the action area are all highly migratory and found in both state and federal waters off Florida. The vast majority of both state and federal fishing effort occurs in the depth range (0-120 ft) where sea turtles are known to occur most frequently; thus, neither fishery is likely to have a disproportionate rate of entanglement of sea turtles. Since the gear, timing, and distribution of effort with respect to sea turtle abundance, are essentially the same in both state and federal waters, we believe the number of traps fished in the state and federal fisheries is the best predictor of sea turtle entanglements.

5.4.1.1 Summary of Data Used to Estimate Sea Turtle Takes

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

The data contained in this database are the best and only available on sea turtle entanglements in stone crab trap gear in the action area. Querying this database returned 13 records of sea turtle entanglement in stone crab trap gear in both state and federal waters within the stone crab management area (see Table 5.1 and Figure 5.1), during the 2005-2006 through 2007-2008 fishing years (STSSN Database, unpublished data). Three of these records noted the animal was dead when found, while the remaining 10 animals were alive at the time of discovery.

Figure 5.1 Location of Sea Turtle Strandings/Incidental Captures in Stone Crab Trap Gear for the 2005-2006, 2006-2007, and 2007-2008 Fishing Seasons



Florida Marine Fisheries Trip Ticket Program
Commercial fisheries landings and fishing effort data have been collected by the state of Florida since November 1984. Florida law (Chapters 370.021, .06(2)(a), 370.07(6)(a), and Administrative Code 68E-5.002) requires that all sales of seafood products from the waters of Florida be reported on a Marine Fisheries Trip Ticket at the time of sale. Trip tickets include information about the harvester, the dealer purchasing the product, the date of the transaction, the county in which the species was landed, time fished, gear(s) used, and pounds of each species landed for each trip. Completed tickets are mailed to the Florida Fish and Wildlife Conservation Commission, where they are processed (FFWCC website; http://www.floridamarine.org/features/view_article.asp?id=23423).

5.4.1.2 Estimating Sea Turtle Take in the Commercial Stone Crab Trap Fishery

Estimating Sea Turtle Take Rates Per Fishing Year
We began by assigning the STSSN sea turtle entanglement records to a specific commercial stone crab fishing season (October 15-May 15) based on the date the stranding was documented (Table 5.1). Three stranding records could not be assigned to a specific fishing season using this method. Since these events were documented as stone crab gear entanglement, we believe they should be included in our analysis. We also believe it is reasonable to assume these entanglements occurred as a result of fishing in the season immediately preceding the date of the stranding (i.e., the stranding documented on June 9, 2006, was likely the result of fishing that occurred during the

2005-2006 season). Therefore, we assigned these strandings to the fishing seasons immediately preceding them.

Table 5.1 Sea Turtle Stranding Records Noting Crab Trap Gear Entanglement

Fishing Season	Month	Day	Species	Area	Condition
2005-2006	04	17	Kemp's Ridley	FL- Gulf of Mexico	Alive
2005-2006*	06	09	Loggerhead	FL- Gulf of Mexico	Dead
2005-2006*	07	25	Unidentified	FL- Gulf of Mexico	Alive
2006-2007	01	03	Loggerhead	FL- Gulf of Mexico	Alive
2006-2007	02	10	Loggerhead	FL- Gulf of Mexico	Dead
2006-2007	04	27	Unidentified	FL- Gulf of Mexico	Alive
2006-2007	03	15	Loggerhead	FL- Gulf of Mexico	Dead
2006-2007	05	06	Loggerhead	FL- Gulf of Mexico	Alive
2006-2007*	08	14	Unidentified	FL- Gulf of Mexico	Alive
2007-2008	10	13	Loggerhead	FL- Gulf of Mexico	Alive
2007-2008	12	09	Unidentified	FL- Gulf of Mexico	Alive
2007-2008	10	17	Loggerhead	FL- Gulf of Mexico	Alive
2007-2008	11	09	Leatherback	FL- Gulf of Mexico	Alive

*These are records conservatively assigned to the fishing season immediately preceding the date of the event.

While these data are the best available regarding sea turtle interactions with stone crab trap gear, determining what proportion of all stone crab gear induced strandings these records actually represent is difficult. 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 entanglements caused by trap/pot gear (Murphy and Hopkins-Murphy 1989, Epperly et al. 1996). Studies of at-sea mortalities indicate stranding data only represent between 5 percent and 28 percent of all moralities occurring at sea (Hopkins-Murphy 1989, Epperly et al 1996, TEWG 1998, Hart et al. 2006). NMFS SEFSC (2001) states that on average, the number of dead sea turtle strandings represent 20 percent, at best, of all at-mortalities. We also believe it is likely that the number of live sea turtle strandings reported is only a small fraction of the total actually occurring. Unfortunately, there are currently no estimates available of of what percentage of live sea turtles strandings are actually reported. We addressed this potential under-representation by dividing the number of sea turtles strandings each year, by 20 percent (Table 5.2).

Table 5.2 Original and Adjusted Estimates of Sea Turtle Strandings

Fishing Year	Number of STSSN Stranding Events	Adjusted Stranding Events
2005-2006	3	15
2006-2007	6	30
2007-2008	4	20
Total	**13**	**65**

Next, we used the best available data on the commercial fishery to tabulate and calculate the amount of commercial trap fishing effort in the fishery during the 2005-2006, 2006-2007, and 2007-2008 fishing years (Florida Fish and Wildlife Conservation Commission, Marine Fisheries Trip Ticket Program, unpublished data). Effort can be measured in variety of ways including: number of traps available, total number of trips, traps fished, sets, hours fished, and soak time. Since we believe the likelihood of sea turtle entanglement is dependent on the amount of time the trap spends in the water, we used trap soak time for calculating entanglements (Table 5.3).

We multiplied the number of traps pulled by the number of days each trap soaked as recorded on trip tickets – for records with a soak time less than one day, we divided the number of hours soaked by 24 – to estimate total trap soak days for each month and fishing year. By summing the total trap soak days, we estimated the total number of trap soak days for the entire fishery (Table 5.3). Since each trap can be used more than once during a fishing season, the number of traps pulled is greater than the number of total traps issued.

Table 5.3 Total Trap Soak Days in Federal and State Waters

Fishing Year	No. of Traps Pulled Each Year	Total Trap Soak Days
2005-2006	9,343,956	74,017,746
2006-2007	11,823,639	88,898,482
2007-2008	10,519,955	83,150,662
2004/05-2007/08	31,687,550	246,066,890

Next, we divided our annual adjusted sea turtle stranding estimates (Table 5.2) by the number of trap soak days for each fishing year; yielding an estimate of sea turtle takes per trap soak day (Table 5.4). The sea turtle take rates were far less than one. They ranged from a low of $2.1 x 10^{-7}$ interactions per trap soak day in the 2005-2006 fishing year, to a high of $3.3 x 10^{-7}$ takes per trap soak day during the 2007-2008 fishing year.

Table 5.4 Sea Turtle Take Rates Per Trap Soak Day

Fishing Year	Total Trap Soak Days	Sea Turtle Strandings (Adjusted)	Sea Turtle/Soak Day Interaction Rate
2005-2006	74,017,746	15	0.0000002
2006-2007	88,898,482	30	0.00000034
2007-2008	83,150,662	20	0.00000024
2004/05-2007/08	246,066,890	65	--

Sea Turtle Takes in the Federal Stone Crab Trap Fishery

As noted in section 5.4.1.1, we believe the sea turtle take rate per trap would be essentially the same in both state and federal waters. However, since the proposed action is the continued authorization of the federal fishery, we applied the above sea turtle take rates to the trap effort in the federal fishery only, to address differences in fishing effort in the state and federal fisheries. Using Florida Trip Ticket information, we calculated the percentage of all traps in the fishery that are fished in federal waters. Applying that percentage to the total trap soak days used each year, we estimated the number of trap soak days in the federal fishery. Multiplying those figures by our sea turtle take rate yielded the number of sea turtle takes by stone crab traps in federal waters (Table 5.5).

We estimate 23.74 sea turtles takes occurred during the 2005-2006 through 2007-2008 fishing years.

Table 5.5 Estimated Sea Turtle Takes in Federal Waters

Fishing Year	Total Trap Soak Days in Federal Waters	Sea Turtle/Trap Interaction rate	No. of Sea Turtle Takes
2005-2006	33,291,870	0.0000002	6.65
2006-2007	30,994,191	0.00000034	10.53
2007-2008	27,371,225	0.00000024	6.56
2004/05-2007/08	91,657,286	--	23.74

Estimating Mortality

Next, we estimated how many of these takes may have resulted in mortality. While we believe only a portion of at-sea entanglements caused by stone crab traps are represented as strandings, they represent the best way available to monitor lethal takes. Our strandings records indicate that 23 percent of sea turtle entanglements in stone crab trap gear result in mortality. However, it is impossible to ascertain what role the entangling gear actually played in causing the mortality of these animals. Likewise, it is impossible to determine how entangling gear would have affected the live sea turtles if the gear had not been removed. While we acknowledge these potential biases exist, we have no way of non-arbitrarily addressing them. Therefore, we use our estimate of 23 percent mortality when calculating the number of lethal takes.

Estimating Sea Turtle Takes by Species

To conduct our jeopardy (risk) analysis and effectively assess the impacts of incidental takes, we must assign take for individual species. We rely on what we know about sea turtle relative abundance in the action area to arrive at take estimates for each sea turtle species.

Given that fishery operates close to shore, we believe using STSSN data to estimate species composition is appropriate. We initially produced a sea turtle species composition estimate with the 13 sea turtle stranding records returned from our STSSN query (Table 5.6). However, we were concerned that this small sample size might underestimate the potential risk of entanglement of other sea turtle species we believe are likely to occur in the action area. For example, hawksbill and green sea turtles are known to inhabit the nearshore areas where stone crab trap fishing is common and could potentially become entangled. To address these issues, we expanded our sample size by including all STSSN stranding reports from statistical zones 1 through 10, 24, and 25 (Figure 5.2 and 5.3). The management area for the federal stone crab fishery is completely encompassed by these zones. We aggregated all sea turtle stranding data available from these statistical zones during the fishing years 2005-2006 through 2007-2008 to estimate sea turtle species composition (Table 5.7). These data indicate loggerheads are the most abundant, followed by green sea turtles.

Table 5.6 Sea Turtle Species Composition Derived from 13 Queried STSSN Records

Species	No. of Strandings	% of Total Strandings
Loggerhead	7	53.8
Leatherback	1	7.7
Kemp's Ridley	1	7.7
Unknown	4	30.7
Total	13	--

Table 5.7 Sea Turtle Species Composition Derived from All STSSN Records in Statistical Zones 1-10, 24, & 25

Species	No. of Strandings	% of Total Strandings
Loggerhead	1,102	66.87
Green	225	13.65
Leatherback	26	1.58
Hawksbill	39	2.37
Kemp's Ridley	194	11.77
Unknown	62	3.76
Total	1,648	--

(STSSN Database, Accessed October 3, 2008)

Figure 5.2 STSSN Statistical Zones for the Gulf of Mexico Region

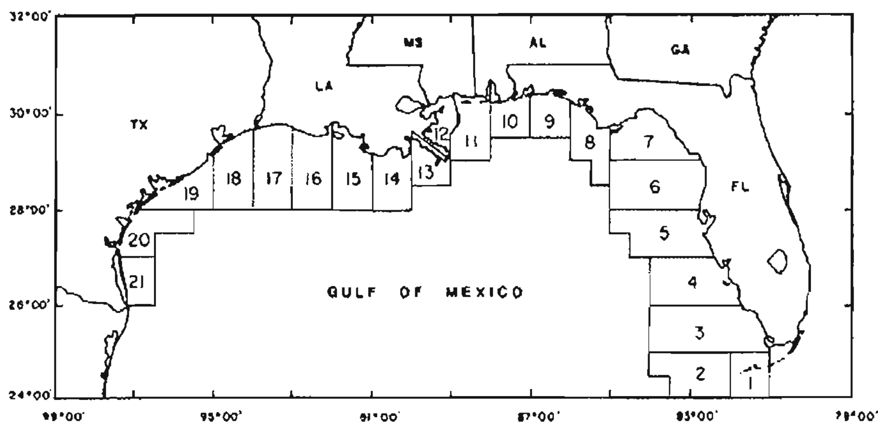
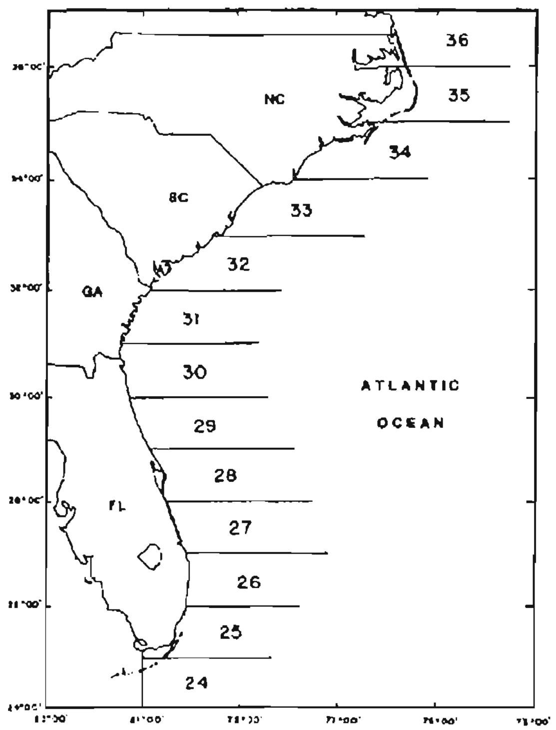


Figure 5.3 STSSN Statistical Zones for the South Atlantic Region



We chose to use the species composition estimate from all STSSN records (Table 5.8) because it represents a much larger sample size. It also includes records of hawksbill and green sea turtles; two species we believe are likely to occur in the action area but were not present in the smaller sample size. Therefore, we believe this species composition best represents the species likely to be in area. By multiplying our take estimate by species composition derived from the larger STSSN sample (Table 5.7) we estimated the total number of take for each species. We then multiplied that number by our mortality estimates listed above, to calculate the non-lethal and lethal takes by species: 15.89 loggerheads (3.65 lethal); 3.24 green (0.74 lethal); 0.37 leatherbacks (0.03 lethal); 0.56 hawksbill (0.13 lethal) and 2.79 Kemp's ridley (0.64 lethal) sea turtles. Since it is not possible to take a partial sea turtle, we rounded our calculations up to the nearest whole number.

Because both our lethal and non-lethal take estimates for hawksbills and leatherbacks are less than one, we believe rounding both estimates to the nearest whole number would overestimate the level of adverse affects from the fishery. Therefore, we believe only one take for each species occurred, but that take could have been either lethal or non-lethal. Therefore, we estimate that during the 2005-2006 through 2007-2008 fishing years, 16 loggerhead (12 non-lethal, 4 lethal), 4 green (3 non-lethal, 1 lethal), 3 Kemp's ridley (2 non-lethal, 1 lethal), 1 hawksbill (lethal or non-lethal), and 1 leatherback sea turtle (lethal or non-lethal) take occurred. Table 5.8 summarizes these estimates.

Table 5.8 Estimated Lethal and Non-Lethal Sea Turtle Takes in the Federal Fishery, 2005-2006 Through 2007-2008 Fishing Years

<table>
<tr><th rowspan="2">Species</th><th colspan="3">Number of Takes</th></tr>
<tr><th>Non-Lethal</th><th>Lethal</th><th>Total</th></tr>
<tr><td>Loggerhead</td><td>12</td><td>4</td><td>16</td></tr>
<tr><td>Green</td><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Kemp's Ridley</td><td>2</td><td>1</td><td>3</td></tr>
<tr><td>Hawksbill</td><td colspan="2">1</td><td>1</td></tr>
<tr><td>Leatherback</td><td colspan="2">1</td><td>1</td></tr>
</table>

5.5.2 Estimating Past Smalltooth Sawfish Take by Commercial Stone Crab Traps

Smalltooth sawfish could become entangled in stone crab trap lines. In the following section, we analyze and quantify the adverse effects to smalltooth sawfish from entanglement in stone crab trap lines traps.

5.5.2.1 Data Used for Estimating Smalltooth Sawfish Takes

The best available data for estimating smalltooth sawfish takes come from two encounter databases, one maintained by Gregg Poulakis (Florida Fish and Wildlife Commission, Fish and Wildlife Research Institute) and Jason Seitz (Florida Museum of Natural History) and another maintained by Mote Marine Laboratory (MML). Each of these datasets is discussed below.

Poulakis and Seitz Database
Biologists Gregg Poulakis and Jason Seitz maintain a non-validated database of recent smalltooth sawfish encounters (1990 to present) from Gulf of Mexico and South Atlantic waters off south Florida. At least 2,969 individual animals have been documented in this database. Poulakis and Seitz (2004) document 1,632 sawfish encounters in Florida Bay and the Keys between 1990 and 2002; approximately 89 percent of these occurred between 1998 and 2002. Most sawfish encounters were reported as a single fish caught on hook-and-line or observed in the water by divers/swimmers, but several sawfish were also observed together. Virtually all of the captured sawfish were the bycatch of fishers targeting sharks, tarpon, snook, or red drum.

MML Database
As discussed in Section 3.2.8, MML maintains a statewide database for Florida of validated smalltooth sawfish encounters from 1998 through the present. From January 1998 through May 2006, MML validated 840 observations of smalltooth sawfish (1,177 individuals) (MML unpublished data). The majority of these encounters (66 percent) occurred during fishing. The encounter data presented in Simpfendorfer and Wiley (2004) suggests that outside of its core range, the smalltooth sawfish appears more common on the west coast of Florida and the Florida Keys. Although the overall latitudinal spread of encounters was similar off both coasts, encounters off the east coast were much less common. The majority of the east coast encounters occurred south of 27.2°N with no east coast areas having encounters rates greater than 0.03 per km

(Simpfendorfer and Wiley 2004). Observations are based on sightings densities that have not been corrected for sightings effort, however, so may be somewhat biased by the amount of fishing effort (i.e., more fishing effort in the Gulf of Mexico state waters than off the Atlantic coast).

These datasets show no documented smalltooth sawfish entanglements specific to stone crab trap gear within the last 10 years. However, we know of at least two entanglements in spiny lobster trap gear (Seitz and Poulakis 2006; T. Wiley, pers. comm. 2007). Both occurred off the Florida Keys in 2001 and 2002. One animal was released alive; the condition of the other upon release is not known.

5.5.2.2 Estimating Smalltooth Sawfish Trap Takes

Smalltooth sawfish is an easily identifiable species that was not listed under the ESA until 2003. Because they are relatively rare, easily distinguishable, and only recently protected by law, we believe smalltooth sawfish entanglements in stone crab trap gear would be rare and likely to have been reported if they had occurred. Therefore, we believe the lack of any documented interactions between smalltooth sawfish and stone crab trap gear is likely true. However, given the similarities between stone crab trap gear and spiny lobster trap gear (a gear type known to entangle smalltooth sawfish) we believe entanglement is possible. Additionally, commercial stone crab trap fishing is concentrated in southwestern Florida, an area within the core range of the species. These two factors lead us to believe the possibility of entanglement for smalltooth sawfish is real and not addressing it may underestimate the risk of entanglement.

When faced with uncertainty, ESA case law dictates we err on the side of the species, and resolve uncertainty in such a manor as to avoid underestimating risk to listed species. In following this policy, we apply a precautionary approach and estimate that one smalltooth sawfish take may have occurred between the 2005-2006 and 2007-2008 fishing seasons. We believe this number neither underestimates entanglement risk, nor overestimates the fishery's potential to adversely affect the species.

Estimating Mortality
To estimate the likelihood of mortality due to entanglement in trap gear, we looked at the information available regarding the entanglements in spiny lobster trap gear. That information suggests one entangled smalltooth sawfish was released alive and in good condition, while the condition of the other animal at the time of release was not known. These records suggest that smalltooth sawfish survive at least some portion of entanglements, if not all. Smalltooth sawfish physiology likely helps reduce the severity of impacts resulting from entanglement. They naturally lay on the sea floor, using their spiracles to breathe (Simpfendorfer pers. comm. 2003). This adaptation allows them to breathe normally without actively swimming. Thorson (1982) reports examples of largetooth sawfish caught by fishers at night or when no one was present to tag them, surviving, tethered by their rostrums, in the water for several hours with no apparent harmful affects. This evidence leads us to believe entanglement is extremely unlikely to

result in mortality. Therefore, based on this information we believe a smalltooth sawfish entanglement in stone crab trap gear would be non-lethal.

5.6 Anticipated Future Take Resulting from the Continued Authorization of the Gulf of Mexico Stone Crab Fishery

In the preceding sections, we extrapolated our best available data to estimate the number of sea turtle and smalltooth sawfish takes occurring in the Gulf of Mexico stone crab fishery from 2005-2006 through 2007-2008. We now must consider what effect, if any, the continued authorization of the fishery would have on future levels of take (i.e., whether the levels of lethal and non-lethal take occurring in the past are likely to change in the future). Since the number of traps available to the fishery cannot increase [F.A.C. 68B-13.010(3)(f)] we believe the sea turtle and smalltooth sawfish interaction patterns that existed in the recent past are likely to continue into the future. Below is a summary of our projections of actual take by species.

Because of the high degree of variability in takes associated with fluctuations in water temperatures, species abundances, and other factors that cannot be predicted, a 3-year take estimate was used for the incidental take statement (ITS). Annual take estimates have high variability because of natural and anthropogenic variation. It is unlikely that all species evaluated in this opinion will be consistently impacted year after year by the fishery. Some years may have no interactions, while others may have several. The latter scenario can cause an annual take level to be exceeded as a result of a potentially anomalous event. As a result, monitoring fisheries using 1-year estimated take levels is largely impractical. However, too long of a time frame is also problematic. We are electing to authorize take for 3-year time periods because this is consistent with our estimates of take occurring during the 2005-2006 through 2007-2008 fishing seasons. This approach reduces the likelihood of requiring reinitiation unnecessarily, while still allowing for an accurate assessment of how the fishery is performing versus expectations.

Estimating Triennial Sea Turtle Take Levels
The current cap on the number of traps available to the fishery is extremely unlikely to increase over the next three years [F.A.C. 68B-13.010(3)(f)]. Additionally, an action to increase the number of traps available in the fishery would represent a modification to the proposed action and a section 7 consultation could be reinitiated to evaluate any new risks to protected species not previously considered. For these reasons we believe it is reasonable to assume the level of take we estimated to have occurred over the last three years is likely to continue into the future.

However, our estimates of the past takes include likely at-sea strandings that were not documented. To monitor future take, we must estimate the number of sea turtles likely to be documented with stone crab trap gear entanglements. To estimate the number of takes that would be documented in stranding records we reduced our take estimate for each species by 80 percent. When we apply that percentage to our estimates, and round up to nearest whole number, only the number of loggerhead takes changes. Therefore, while we anticipate 16 loggerhead takes will occur every three years, only 13 will be documented in stranding records. The documentation of more than 13 loggerhead entanglement in stone crab trap gear would require reinitiating consultation. We anticipate all takes of the other species to be documented. Table 5.9 summaries the anticipated level of take for each species over any 3-year period.

Estimating Triennial Smalltooth Sawfish Take Levels
There have been no documented interactions between the stone crab trap gear and smalltooth sawfish. Without any documented interactions we will use a precautionary approach. Since gears similar to stone crab traps (i.e., spiny lobster traps) have entangled smalltooth sawfish, we believe smalltooth sawfish entanglement in stone crab trap gear is possible. But because there have been no documented entanglement we believe the likelihood of entanglement is low. Therefore, we anticipate no more than one non-lethal smalltooth sawfish take may occur during any 3-year period. We believe using this take estimate provides an adequate degree of precaution.

5.7 Summary

Based on our review in this section, Gulf of Mexico stone crab traps have adversely affected sea turtles in the past via entanglement and forced submergence. We believe these adverse effects to sea turtles, and the potential for adverse effects to smalltooth sawfish are likely to continue in the future. The other gear types/fishing techniques used in the Gulf of Mexico stone crab fishery – recreational diving/wading – are not likely to have adversely affected sea turtles or smalltooth sawfish and are unlikely to do so in the future. We have estimated the level of take we believe is likely to occur every three years in the future; Table 5.9 summarizes those estimates.

Table 5.9 Estimated Future 3-Year Take Estimates

<table>
<tr><th rowspan="2">Species</th><th colspan="3">Number of Takes</th></tr>
<tr><th>Non-Lethal</th><th>Lethal</th><th>Total</th></tr>
<tr><td>Loggerhead</td><td>12</td><td>4</td><td>16*</td></tr>
<tr><td>Green</td><td>3</td><td>1</td><td>4</td></tr>
<tr><td>Kemp’s Ridley</td><td>2</td><td>1</td><td>3</td></tr>
<tr><td>Hawksbill</td><td colspan="2">1</td><td>1</td></tr>
<tr><td>Leatherback</td><td colspan="2">1</td><td>1</td></tr>
<tr><td>Smalltooth sawfish</td><td>1</td><td>0</td><td>1</td></tr>
</table>

*Only 13 of these takes are expected to be recorded in stranding records.

6.0 Cumulative Effects

Cumulative effects are the effects of future state, local, or private activities that are reasonably certain to occur within the action area considered in this biological opinion. 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. Within the action area, major future changes are not anticipated in ongoing human activities described in the environmental baseline. The present, major human uses of the action area, such as commercial fishing, recreational boating and fishing, and shipping of goods through the area, are expected to continue at the present levels of intensity in the near future as are their associated risks of injury or mortality to sea turtles and smalltooth sawfish posed by incidental capture by fishermen, accidental oil spills, vessel collisions, marine debris, chemical discharges, and man-made noises.

Beachfront development, lighting, and beach erosion control are all ongoing activities along the Gulf coasts of the United States. These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, an increasing number of coastal counties have or are adopting more stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting. Some of these measures were drafted in response to law suits brought against the counties by concerned citizens who charged the counties with failing to uphold the ESA by allowing unregulated beach lighting which results in takes of hatchlings.

Urbanization in many southeastern coastal states has resulted in substantial loss of coastal habitat through activities such as agricultural and urban development (wetland conversion, flood control and diversion projects, dredge-and-fill operations). Smalltooth sawfish are particularly vulnerable to coastal habitat degradation because of their affinity for shallow, estuarine systems. Marine pollutants and debris may also negatively impact smalltooth sawfish if it gets caught on their saw and interfere with feeding.

State-regulated commercial and recreational boating and fishing activities in local waters currently result in the incidental take of threatened and endangered species. It is expected that states will continue to license and permit large vessel and thrill-craft operations that do not fall under the purview of a federal agency, and will issue regulations that will affect fishery activities. Recreational hook-and-line fisheries have been known to take sea turtles and smalltooth sawfish. Future cooperation between NMFS and the states on these issues should help decrease take of sea turtles caused by recreational activities. NMFS will continue to work with states to develop ESA section 6 agreements and section 10 permits to enhance programs to quantify and mitigate these takes.

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

7.0 Jeopardy Analysis

The analyses conducted in the previous sections of this opinion serve to provide a basis to determine whether the proposed action would be likely to jeopardize the continued existence of any ESA-listed sea turtles or smalltooth sawfish. In Section 5, we outlined how the proposed action can affect these species and the extent of those effects in terms of estimates of the numbers of sea turtles and smalltooth sawfish caught and injured or killed. Now we turn to an assessment of each species' response to this impact, in terms of overall population effects from the estimated take. We also evaluate whether the effects of the proposed action, when considered in the context of the status of the species (Section 3), the environmental baseline (Section 4), and the cumulative effects (Section 6), will jeopardize the continued existence of the affected species.

"To jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to appreciably reduce the likelihood of both the survival and the recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). Thus, in making this determination for each species, we must 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.

7.1 Effects of the Action on the Likelihood of Sea Turtles' Survival and Recovery in the Wild

In two steps, this section analyzes if the anticipated take from the proposed action will reduce the likelihood of green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles' survival and recovery in the wild. First, we evaluate how each species' population is likely to respond if takes were non-lethal or lethal. Then we evaluate whether the anticipated take will result in any reduction in distribution, reproduction, or numbers of each species that may appreciably reduce the likelihood of survival. Second, we consider how anticipated take is likely to affect these species' recovery in the wild by considering recovery objectives in the recovery plans of each species. Since incidental take affects individuals, some of which may be reproductively mature, we pay specific attention to those objectives that may be affected by reductions in the numbers or reproduction of resulting from the proposed action.

7.1.1 Green Sea Turtles

Survival in the Wild
The proposed action may result in three green sea turtle takes, three non-lethal and one lethal, during any consecutive 3-year period.

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

The potential lethal take of one green sea turtle every three years 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. A lethal take could also result in a reduction in future reproduction, assuming the individual was female and would have survived to reproduce. For example, an adult green sea turtle can lay 1-7 clutches (usually 2-3) of eggs every 2 to 4 years, with 110-115 eggs/nest. The annual loss of an adult female sea turtle, on average, could preclude the production of thousands of eggs and hatchlings, of which a fractional percentage are expected to survive to sexual maturity. The anticipated lethal take is 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 attributed to stone crab fishery 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 a generally positive trend during the ten years of regular monitoring since establishment of index beaches in Florida in 1989. An average of 5,039 green turtle nests were laid annually in Florida between 2001 and 2006 with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a).

Although the anticipated mortality would result in an instantaneous reduction in absolute population numbers, the U.S. populations of green sea turtles would not be appreciably affected. For a population to remain stable, sea turtles must replace themselves through successful reproduction at least once over the course of their reproductive lives, and at least one offspring must survive to reproduce itself. If the hatchling survival rate to maturity is greater than the mortality rate of the population, the loss of breeding individuals would be replaced through recruitment of new breeding individuals from successful reproduction of non-taken sea turtles. Since the abundance trend information for green sea turtles is either stable or increasing, we believe the loss of a green sea turtle every three years will have no measurable effect on that trend.

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

Recovery in the Wild

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

- The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years;

- Green turtle nesting in Florida over the past six years has been documented as follows: 2002 – 9,201 nests, 2003 – 2,622 nests, 2004 – 3,577 nests, 2005 – 9,644 nests, 2006 – 4,970 nests (NMFS and USFWS 2007a), and 2007 – 12,752 (FWRI 2007). This averages 7,127 nests annually over the past 6 years.

- A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.
    - Several actions are being taken to address this objective; however, there are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds.

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

7.1.2 Hawksbill and Leatherback Sea Turtles

Survival in the Wild

The proposed action may result in up to one hawksbill and one leatherback sea turtle take (lethal or non-lethal) during consecutive 3-year periods.

The non-lethal take every three years of up to one hawksbill and one leatherback sea turtle is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. That individual is expected to fully recover such that no reductions in reproduction or numbers of these species are anticipated. Since the takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of hawksbill or leatherback sea turtles is anticipated.

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

Whether the reductions in numbers and reproduction of these species attributed to the stone crab fishery 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 hawksbill sea turtles states their populations appear to be increasing or stable at the two principal nesting beaches in the U.S. Caribbean where long-term monitoring has been carried out: Mona Island, Puerto Rico, and Buck Island Reef National Monument (BIRNM), St. Croix, USVI (NMFS 2007b). Mona Island hosts between 199-332 nesting females per season, while 56 females nest at BIRNM per season (NMFS 2007b). Although today's nesting population is only a fraction of what it was, nesting activity in recent years by hawksbills has increased on well-protected beaches in Mexico, Barbados, and Puerto Rico (Caribbean Conservation Corporation 2005). Increasing protections for live coral habitat over the last decade in the Atlantic, Gulf of Mexico, and Caribbean may also increase survival rates of hawksbills in the marine environment.

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).[7]

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

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

[7] 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).

Recovery in the Wild

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

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

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

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

substantial increase in leatherback nesting in Florida since 1989. The estimated annual growth rate was approximately 1.18 (with an estimated 95 percent interval of 1.1 to 1.21) (NMFS and USFWS 2007d).

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

7.1.3 Kemp's Ridley Sea Turtles

Survival in the Wild
The proposed action may result in up to three Kemp's ridley sea turtle takes, two non-lethal and one lethal, during consecutive 3-year periods.

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

The lethal take of up to one Kemp's ridley every three years by the Gulf of Mexico stone crab fishery would reduce the species' population by one, compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. A lethal take could also result in a potential reduction in future reproduction, assuming the individual was a female and would have survived to reproduce in the future. The annual loss of one adult female sea turtle, on average, could preclude the production of thousands of eggs and hatchlings, of which a fractional percentage is expected to survive to sexual maturity. Thus, the death of a female eliminates that individual's contribution to future generations, and the action will result in a reduction in sea turtle reproduction. The anticipated take is 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 an individual.

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

The total population of Kemp's ridleys is not known, but nesting has been increasing significantly in the past several years (9 to 13 percent per year) with preliminary estimates for 2008 of over 17,000 nests (S. Epperly, Southeast Fisheries Science Center, pers. comm. 2008). Kemp's ridleys mature and nest at an age of 7-15 years, which is earlier than other chelonids. A younger age at maturity may be a factor in the response of this species to recovery actions. A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles. The increased survivorship of immature sea turtles is largely attributable to the introduction of turtle excluder devices (TEDs) in the United States and Mexican shrimping fleets and Mexican beach protection efforts. The TEWG (2000) projected that Kemp's ridleys could reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015.

Although the anticipated mortality would result in a reduction in absolute population numbers, it is not likely this reduction would appreciably reduce the likelihood of survival of Kemp's ridley sea turtles. If the hatchling survival rate to maturity is greater than the mortality rate of the population, the loss of breeding individuals would be replaced through recruitment of new breeding individuals from successful reproduction of non-taken sea turtles. Considering that Kemp's ridley nesting trends are increasing, we believe the loss of up to one individual every three years will not have any measurable effect on that trend.

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

Recovery in the Wild
The recovery plan for Kemp's ridley sea turtles (USFWS and NMFS 1992) lists the following relevant recovery objective:

- Attain a population of at least 10,000 females nesting in a season.
  - An estimated 4,047 females nested in 2006, which is a substantial increase from the 247 nesting females estimated during the 1985 nesting season (P. Burchfield, Gladys Porter Zoo, personal communication, 2007, in NMFS and USFWS 2007c).
  - In 2007, an estimated 5,500 females nested in the state of Tamaulipas from May 20-22 (P. Burchfield, Gladys Porter Zoo, personal communication, 2007, in NMFS and USFWS 2007c).
  - 10,000 nesting females in a season = about 30,000 nests (NMFS and USFWS 2007c).

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

7.1.4 Loggerhead Sea Turtles

Survival in the Wild

The proposed action may result in up to 16 loggerhead sea turtle takes, 12 non-lethal and four lethal, during consecutive 3-year periods.

The potential non-lethal take every three years of 12 loggerhead sea turtles is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. These individuals are expected to fully recover such that no reductions in reproduction, or numbers of loggerhead sea turtles are anticipated. Since these takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of loggerhead sea turtles is anticipated.

The potential lethal take of four loggerhead sea turtles every three years would reduce the number of loggerheads as compared to their numbers in the absence of the proposed action, assuming all other variables remained the same. Lethal takes could also result in a potential reduction in future reproduction, assuming these individuals were female and would have survived to reproduce. 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 four adult female sea turtles, on average, could preclude the production of thousands of eggs and hatchlings of which a small percentage are expected to survive to sexual maturity. These 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 loggerhead sea turtles is expected from the take of an individual.

Whether the reductions in numbers and reproduction of loggerhead sea turtles attributed to stone crab fishery would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

Regarding the Florida nesting group of loggerhead sea turtles, a trend analysis of the nesting data collected for Florida's Index Nesting Beach Survey (INBS) program showed a decrease in nesting of 22.3 percent in the annual nest density of surveyed shoreline over a 17-year period (1989-2005) and a 39.5 percent decline since 1998 (letter to NMFS from the Director, Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, October 25, 2006; Meylan et al. 2006). Data collected in Florida for the 2007 loggerhead nesting season reveals that the decline in nest numbers has continued, with even fewer nests counted in 2007 in comparison to any previous year of the period, 1989-2007 (Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation

Commission web posting November 2007). With respect to the northern nesting group of loggerheads, standardized ground surveys of 11 North Carolina, South Carolina, and Georgia nesting beaches showed a significant declining trend of 1.9 percent annually in loggerhead nesting from 1983-2005 (NMFS and USFWS 2007e). Aerial surveys conducted by the South Carolina Department of Natural Resources showed a 3.1 percent annual decline in nesting since 1980 (Dodd 2003, NMFS and USFWS 2007e). The South Carolina data represents approximately 59 percent of nesting by the northern nesting group (Dodd 2003). A significant declining trend in loggerhead nesting of 6.8 percent annually from 1995-2005 has also been detected for the Florida Panhandle nesting group (NMFS and USFWS 2007e). Nesting for the Yucatán nesting group is characterized as having declined since 2001 while no trend is detectable for the Dry Tortugas nesting group (NMFS and USFWS 2007e).

However, these declines need to be viewed in the context of the number of nests observed and are not necessarily applicable to the population as a whole. While the number of nests is a proxy for the size of the adult nesting female population, nesting declines do not necessarily mean the numbers of adult females are declining. Likewise, nesting declines do not necessarily mean the population or stock is declining as a whole. The method of converting the number of nests to the number of females is also confounded by several factors, for example the variability in number of nests per female per year or the variability in the remigration interval. Additionally, nest counts alone do not provide any insight into the status of other age classes or the male population (letter from N. Thompson, NMFS Northeast Fisheries Science Center, to J. Lecky, NMFS Office of Protected Resources, December 4, 2007).

These declining nesting beach trends also seem in contradiction to some in-water survey results. Epperly et al. (2007) reported an annual increase of 13.2 percent in loggerhead catch per unit effort (CPUE) off North Carolina during sea turtle sampling in 1995-1997 and 2001-2003. Ehrhart et al. (2007) also reported a significant increase in loggerhead CPUE over the last four years in the Indian River Lagoon, Florida. Entrainment of loggerheads at St. Lucie Power Plant on Hutchison Island, Florida, has also increased at an average rate of 11 percent per year from 1998 to 2005 (M. Bersette pers. comm. in Epperly et al. 2007).

It is unclear whether nesting beach trends, in-water abundance trends, or some combination of both, best represents the actual status of loggerhead sea turtle populations in the Atlantic. Regardless, we do not believe the loss of up to 12 individuals every three years will have a measurable impact on the likelihood of the loggerhead's survival in the wild. Although the declining annual nest density at major loggerhead sea turtle nesting beaches requires further study and analysis to determine the causes and long-term effects on population dynamics, the likelihood of survival in the wild of loggerheads will not be appreciably reduced because of this action. Therefore, we believe that the lethal take of up to 12 loggerhead sea turtles associated with the proposed action is not expected to cause an appreciable reduction in the likelihood of survival of this species of sea turtles in the wild.

Recovery in the Wild
The Atlantic recovery plan for the U.S. population of loggerhead sea turtles (NMFS and USFWS 1991a), herein incorporated by reference, lists the following relevant recovery objective over a period of 25 continuous years:

- The adult female population in Florida is increasing and in North Carolina, South Carolina, and Georgia, it has returned to pre-listing nesting levels (North Carolina = 800 nests/season; South Carolina = 10,000 nests/season; Georgia = 2,000 nests/season).
    - In North Carolina, South Carolina, and Georgia, an average of 5,151 nests per year were documented from 1989-2005, well below the total target of 12,800 nests per season for these three states. Standardized ground surveys of 11 North Carolina, South Carolina, and Georgia nesting beaches showed a significant declining trend of 1.9 percent annually in loggerhead nesting from 1983-2005. In addition, standardized aerial nesting surveys in South Carolina have shown a significant annual decrease of 3.1 percent from 1980-2002.
    - In Florida, the South Florida Nesting Subpopulation showed a decrease in nests of 22.3 percent over the 17-year period from 1989-2005. The Florida Panhandle Nesting Subpopulation showed a significant declining trend of 6.8 percent annually from 1995-2005. No trend in the annual number of nests was detected in the Dry Tortugas Nesting Subpopulation from 1995-2004; because of the annual variability in nest totals, a longer time series is needed to detect a trend.

The potential lethal take of four loggerhead sea turtles during any consecutive 3-year period is not likely to reduce population numbers over time due to current population sizes and expected recruitment. Non-lethal takes of sea turtles would not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action is not in opposition to the recovery objectives above and will not result in an appreciable reduction in the likelihood of loggerhead sea turtles' recovery in the wild.

7.2 Effects of the Action on the Likelihood of Smalltooth Sawfish Survival and Recovery in the Wild

In this section we analyze the effects of the action on the likelihood of survival of smalltooth sawfish in the wild. We evaluate whether the anticipated take will result in any reduction in reproduction, numbers, or distribution of that species that may appreciably increase its risk of extinction in the wild.

The non-lethal take of one smalltooth sawfish during any consecutive 3-year period is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. The vast majority of smalltooth sawfish released after incidental capture show no apparent signs of any negative sub-lethal effects. Although the range of impacts of non-lethal takes are variable, this take estimate represents only those takes for which all animals are expected to fully recover such that no reductions in reproduction or numbers of smalltooth sawfish are anticipated. Since the takes may occur anywhere in the action area and would be released within the general area where caught, no change in the distribution of smalltooth sawfish is anticipated. Only non-lethal take is anticipated; thus, we believe there will be no effect to the population of reproductive adults and thus no appreciable reduction in the likelihood of smalltooth sawfish survival or recovery in the wild.

8.0 Conclusion

We have analyzed the best available data, the current status of the species, environmental baseline, effects of the proposed action, and cumulative effects to determine whether the proposed action is likely to jeopardize the continued existence of any sea turtle species, or smalltooth sawfish.

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

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

9.0 Incidental Take Statement (ITS)

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

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. Nevertheless, F/SER2 must immediately notify (within 24 hours, if communication is possible) NMFS' Office of Protected Resources should a take of a listed marine mammal occur.

9.1 Anticipated Amount or Extent of Incidental Take

NMFS anticipates the following incidental takes may occur in the future as a result of the continued operation of Gulf of Mexico stone crab fishery.

Table 9.1 3-Year Anticipated Future Take in the Gulf of Mexico stone crab fishery

Species	Number of Takes		
	Non-Lethal	Lethal	Total
Loggerhead	12	4*	16
Green	3	1	4
Kemp's ridley	2	1	3
Hawksbill	1		1
Leatherback	1		1
Smalltooth sawfish	1	0	1

*Only one of these takes is expected to be recorded in stranding records.

9.2 Effect of the Take

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

9.3 Reasonable and Prudent Measures (RPMs)

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

The RPMs and terms and conditions are required, per 50 CFR 402.14 (i)(1)(ii) and (iv), to document the incidental take by the proposed action and to minimize the impact of that take on ESA-listed species. These measures and terms and conditions are non-discretionary, and must be implemented by NMFS for the protection of section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this incidental take statement. If it fails to adhere to the terms and conditions of the incidental take statement through enforceable terms, and/or fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of the incidental take, F/SER2 must report the progress of the action and its impact on the species to F/SER3 as specified in the incidental take statement [50 CFR 402.14(i)(3)].

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

1. NMFS must require that captured sea turtles and smalltooth sawfish are handled in a way that minimizes adverse effects from incidental take and reduces mortality.
2. NMFS must ensure that monitoring and reporting of any sea turtles or smalltooth sawfish encountered: (1) detect any adverse effects resulting from the Gulf of Mexico stone crab fishery; (2) assess the actual level of incidental take in comparison with the anticipated incidental take documented in that opinion; and (3) detect when the level of anticipated take is exceeded.

9.4 Terms and Conditions

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

The following terms and conditions implement RPM No. 1.

1. F/SER2, in cooperation with F/SER3, F/SEC, and the State of Florida, shall distribute information to permitted stone crab trap tag holders specifying handling and/or resuscitation requirements fishers must undertake for any sea turtles taken, as stated in 50 CFR 223.206(d)(1-3).
2. F/SER2, in cooperation with the State of Florida, shall inform all stone crab tag holders that disentanglement of sea turtles from trap gear takes priority over transferring catch from traps to vessels. If a sea turtle is cut loose with the line attached, the flipper may eventually become occluded, necrotic, and infected, and this could lead to mortality. Simply cutting lines and leaving entangled gear on sea turtles is strongly discouraged.
3. F/SER2, in cooperation with F/SER3, F/SEC, and the State of Florida, shall also remind permitted stone crab trap tag holders they should take the following actions to safely handle and release an incidentally caught smalltooth sawfish:
    a. Leave the sawfish, especially the gills, in the water as much as possible.
    b. Do not remove the saw or injure the animal in any way.
    c. Use extreme caution when handling and releasing sawfish as the saw can thrash violently from side to side.
    d. If it can be done safely, untangle your line if it is wrapped around the saw.

The following terms and conditions implement RPM No. 2.

4. NMFS must work with the Gulf of Mexico Fishery Management Council and the State of Florida, to implement measures requiring that all stone crab trap rope be a

specific color or contain easily identifiable patterns or markings along their entire lengths that are not currently in use in other fisheries. Easily identifiable ropes must be phased into the federal fishery no later than five years after the finalization of this biological opinion. This will ensure any trap rope affects can be attributed to the appropriate fishery (e.g., stone crab, spiny lobster, or blue crab fisheries).

5. F/SER2, in cooperation with F/SER3, F/SEC, and the State of Florida, must develop a module for STSSN volunteers to provide training on identifying stone crab trap gear and marking buoys. Since sea turtle strandings data is the primary means for monitoring the level of take within the fishery, this training is necessary to increase the accuracy of sea turtle entanglement reports. Additionally, this training will help ensure that sea turtle entanglements in trap gear are attributed to the appropriate fishery (e.g., stone crab, spiny lobster, or blue crab fisheries).

6. F/SER2, in collaboration with the SEFSC, shall submit STSSN stranding reports, including the information below, that show evidence of trap entanglements to F/SER3 by May 1 of each year. NMFS shall continue to review these reports to identify any increase in the number of stone crab/sea turtle trap entanglement related strandings.

    a. The STSSN report shall include information on: species, sex, date (day, month, and year), state, the region where the take occurred (Gulf of Mexico or Atlantic Ocean), the NMFS statistical zone, the latitude and longitude, the animal condition and disposition, and the curved and/or straight carapace length (when available). Photographs should be taken to confirm species identity and release condition, when possible. Any gear associated with the animal should also be documented and photographed.

    b. These reports must be forwarded to the Assistant Regional Administrator for Protected Resources, Southeast Regional Office, Protected Resources Division, 263 13th Avenue South, St. Petersburg, Florida 33701-5505. This report may also be sent electronically to takereport.nmfssero@noaa.gov.

7. NMFS, in cooperation with the Florida Museum of Natural History and Mote Marine Lab, shall continue to monitor each smalltooth sawfish entanglement database, until they are consolidated, for an increase in the number of stone crab trap/smalltooth sawfish trap entanglements.

8. NMFS, in cooperation with the Florida Museum of Natural History, and the State of Florida, shall inform all permitted stone crab trap tag holders that reporting of smalltooth sawfish entanglements is strongly encouraged. Reports should be submitted to:

    a. Joana Fernandez de Carvalho, Research Biologist, Florida Program for Shark Research, Florida Museum of Natural History, University of Florida P.O. Box 117800, Gainesville, Florida 32611
    sawfish@flmnh.ufl.edu

    b. Gregg Poulakis, Florida Fish and Wildlife Conservation Commission, Charlotte Harbor Field Laboratory. 1481 Market Circle-Unit 1, Port Charlotte, Florida 33953-3815
    Gregg.Poulakis@myfwc.com

9. NMFS shall monitor the number of stone crab traps issued annually by the State of Florida. A significant increase in the number of traps issued may indicate an increased risk of entanglement to sea turtles and smalltooth sawfish. An increase in traps may represent new information that would require reinitiation of consultation.

10.0 Conservation Recommendations for Sea Turtles and Smalltooth Sawfish

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. This section provides conservation recommendations for sea turtles and smalltooth sawfish.

The following additional measures are recommended. For F/SER3 to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, F/SER3 requests notification of the implementation of any conservation recommendations.

Sea Turtles:

1. To better understand sea turtle populations and the impacts of incidental take in the Gulf of Mexico stone crab fishery, NMFS should support in-water abundance estimates of sea turtles to achieve more accurate status assessments for these species and improve our ability to monitor them.
2. Once reasonable in-water estimates are obtained, NMFS should support population modeling or other risk analyses of the sea turtle populations affected by the Gulf of Mexico stone crab fishery. This will help improve the accuracy of future assessments of the effects of different levels of take on sea turtle populations.
3. NMFS should encourage the State of Florida to apply for funds available under section 6 of the ESA, to conduct research into the impacts of trap fisheries on sea turtles occurring in state waters.
4. NMFS should encourage the State of Florida to develop and implement programs aimed at helping conserve ESA-listed sea turtles species occurring in state waters.

Smalltooth Sawfish:

5. NMFS should conduct or fund research on the distribution, abundance, and migratory behavior of smalltooth sawfish to better understand their occurrence in federal waters and potential for interaction with stone crab trap gear.
6. NMFS should conduct or fund reproductive behavioral studies to ensure that the incidental capture of smalltooth sawfish in the Gulf of Mexico stone crab fishery is not disrupting any important behaviors.

7. NMFS should consider time/area closures to reduce fishery interactions in areas where significant numbers of smalltooth sawfish interactions occur.

8. NMFS should encourage the State of Florida to develop and implement programs aimed at helping conserve ESA-listed smalltooth sawfish occurring in state waters.

9. NMFS should encourage the State of Florida, to develop regulations that prohibit stone crab trap fishing in waters three feet deep or less. This action would reduce to likelihood of adult smalltooth sawfish becoming entangled in trap lines while using the nearshore areas for breeding. This will also provide protection for younger smalltooth sawfish that use the nearshore environment as nursery habitat.

11.0 Reinitiation of Consultation

This concludes formal consultation on the Gulf of Mexico stone crab fishery. As provided in 50 CFR 402.16, reinitiation of formal consultation is required if discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) The amount or extent of the taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat (when designated) in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological 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

Table 1a The anticipated annual incidental take of loggerhead, green, Kemp's ridley, hawksbill, and leatherback sea turtles as outlined in the most recent opinions on NMFS-authorized federal fisheries.

FISHERY	ANNUAL INCIDENTAL TAKE OF SEA TURTLE SPECIES				
	LOGGERHEAD	GREEN	KEMP'S RIDLEY	HAWKSBILL	LEATHERBACK
ATLANTIC HMS-PELAGIC LONGLINE	635-No more than 113 lethal	35-No more than 6 lethal for Green, Hawksbill and Kemp's ridleys, in combination			588-No more than 28 lethal
ATLANTIC HMS-SHARK FISHERIES	679-No more than 346 lethal	2 – No more than 1 lethal	2 – No more than 1 lethal	2 – No more than 1 lethal	74-No more than 47 lethal
COASTAL MIGRATORY PELAGICS	11-Lethal takes	14-Lethal takes	2-Lethal takes for Leatherbacks, Hawksbill, and Kemp's ridley, in combination		
GULF OF MEXICO/SOUTH ATLANTIC SPINY LOBSTER FISHERY	3-Lethal or non-lethal	3-Lethal or non-lethal	1-Lethal or non-lethal take Leatherback, Hawksbill, or Kemp's ridley, in combination		
GULF OF MEXICO REEF FISH	68-No more than 26 lethal	17-No more than 7 lethal	1-Lethal or non-lethal	15-No more than 5 lethal	7-No more than 3 lethal
SOUTH ATLANTIC SNAPPER-GROUPER	68-No more than 23 lethal	13-No more than 5 lethal	7-No more than 3 lethal	2-No more than 1 lethal	9-No more than 5 lethal
SOUTHEASTERN U.S. SHRIMP	163,160-No more than 3,948 lethal	18,757-No more than 514 Lethal	155,503-No more than 4,208 lethal	640-All lethal	3,090-No more than 80 lethal

Table 1b The anticipated annual incidental take of smalltooth sawfish as outlined in the most recent opinions on NMFS-authorized federal fisheries.

FISHERY	3-YEAR INCIDENTAL TAKE OF SMALLTOOTH SAWFISH
ATLANTIC HMS-SHARK FISHERIES	51 – No more than 1 lethal take
COASTAL MIGRATORY PELAGICS	2 Non-lethal Takes
GULF OF MEXICO/SOUTH ATLANTIC SPINY LOBSTER FISHERY	2 Non-lethal Takes
GULF OF MEXICO REEF FISH	8 Non-lethal Takes
SOUTH ATLANTIC SNAPPER-GROUPER	8 Non-lethal Takes
GULF OF MEXICO SHRIMP TRAWL FISHERY	3 Lethal Takes
SOUTH ATLANTIC SHRIMP TRAWL FISHERY	3 Lethal Takes