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MAR 16 2009

F/SER31:MCB

BG Joseph Schroedel, USA
South Atlantic Division
U.S. Army Corps of Engineers
60 Forsyth Street SW
Atlanta, GA 30303-8801

Dear General Schroedel:

This constitutes the National Marine Fisheries Service's biological opinion (opinion) based on our review of the U.S. Army Corps of Engineers' (COE) proposed action to maintenance dredge the Savannah, Brunswick, and Fernandina Harbor Entrance Channels using hopper dredges from June 1 through September 30, 2009. The opinion analyzes the project's effects on loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), and green *(Chelonia mydas)* sea turtles; shortnose sturgeon (*Acipenser brevirostrum*); and North Atlantic right (*Eubalaena glacialis*) and humpback whales (*Megaptera novaeangliae*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973. It is NMFS' biological opinion that the action, as proposed, may affect, but is not likely to adversely affect, leatherback sea turtles, shortnose sturgeon, and North Atlantic right and humpback whales, though it is likely to adversely affect but is not likely to jeopardize the continued existence of loggerhead, Kemp's ridley, or green sea turtles.

This opinion is based on information provided in your December 19, 2008, letter and a previously submitted biological assessment, as well as information from previous NMFS' consultations conducted on the use of hopper dredges. You are reminded that any changes to the proposed action may negate the findings of the present consultation and may require reinitiation of consultation with NMFS.

We look forward to further cooperation with you on other COE projects to ensure the conservation and recovery of our threatened and endangered marine species. If you have any questions regarding this consultation, please contact Michael Barnette, fishery biologist, at the number listed above, or by e-mail at michael.barnette@noaa.gov.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure

File: 1514-22.F.1.FL
1514-22.F.1.GA
Ref: F/SER/2008/08479

Endangered Species Act – Section 7 Consultation
Biological Opinion

Action Agency: U.S. Army Corps of Engineers (COE), South Atlantic Division (SAD)

Activity: Maintenance Dredging of Savannah, Brunswick, and Fernandina Harbor Entrance Channels June 1 through September 30, 2009 (Consultation Number F/SER/2008/08479)

Consulting Agency: National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS), Southeast Regional Office, Protected Resources Division, St. Petersburg, Florida

Approved By:

Roy E. Crabtree, Ph.D., Regional Administrator
NMFS, Southeast Regional Office
St. Petersburg, Florida

Date Issued: MAR 16 2009

TABLE OF CONTENTS

1 CONSULTATION HISTORY 5
2 DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA 6
3 STATUS OF LISTED SPECIES AND CRITICAL HABITAT 8
4 ENVIRONMENTAL BASELINE 27
5 EFFECTS OF THE ACTION 33
6 CUMULATIVE EFFECTS 40
7 JEOPARDY ANALYSIS 40
8 CONCLUSION 47
9 INCIDENTAL TAKE STATEMENT (ITS) 47
10 CONSERVATION RECOMMENDATIONS 56
11 REINITIATION OF CONSULTATION 58
12 LITERATURE CITED 59
APPENDIX I 72
APPENDIX II 73
APPENDIX III 76
APPENDIX IV 77

Background

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 *et seq*.), requires that each federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species; section 7(a)(2) requires federal agencies to consult with the appropriate Secretary on any such action. The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) share responsibilities for administering the ESA.

Consultation is required when a federal action agency determines that a proposed action "may affect" listed species or designated critical habitat. Consultation is concluded after NMFS determines that the action is not likely to adversely affect listed species or critical habitat or issues a biological opinion (opinion) that identifies whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify critical habitat. The opinion states the amount or extent of incidental take of the listed species that may occur, develops measures (i.e., reasonable and prudent measures - RPMs) to reduce the effect of take, and recommends conservation measures to further conserve the species. Notably, no incidental destruction or adverse modification of critical habitat can be authorized, and thus there are no reasonable and prudent measures, only reasonable and prudent alternatives that must avoid destruction or adverse modification.

This document represents NMFS' opinion based on our review of impacts associated with the proposed channel maintenance dredging activities for Savannah, Brunswick, and Fernandina Harbor Entrance Channels to be conducted June 1 through September 30, 2009, by the SAD. The opinion analyzes project effects on sea turtles (loggerhead, Kemp's ridley, leatherback, and green), whales (North Atlantic right and humpback), and shortnose sturgeon in accordance with section 7 of the ESA, and is based on project information provided by the COE. Information was also obtained from a variety of sources including published and unpublished literature cited herein and other sources of information including the COE Sea Turtle Data Warehouse (http://el.erdc.usace.army.mil/seaturtles/index.cfm; COE 2009).

BIOLOGICAL OPINION

1 CONSULTATION HISTORY

November 25, 1991: NMFS issues a regional biological opinion (RBO), "Dredging of channels in the southeastern United States from North Carolina through Cape Canaveral, Florida."

August 25, 1995: NMFS issues a RBO, "Hopper dredging of channels and beach nourishment activities in the Southeastern United States from North Carolina through Florida East Coast."

April 9, 1997: NMFS issues an interim RBO, "The continued hopper dredging of two channels and two borrow areas in the southeastern United States during 1997."

September 25, 1997: NMFS issues a RBO, "The continued hopper dredging of channels and borrow areas in the southeastern United States." This is the current opinion authorizing threatened and endangered species take pursuant to COE dredging activities in the SAD.

June 23, 2006: NMFS advises SAD that bed-leveler use, apparently widespread in conjunction with hopper dredging projects within the SAD, was not considered in and is not authorized by the September 25, 1997, SAD RBO. NMFS advises SAD that the correct way to address bed-leveling is through reinitiation of consultation on the RBO, since ongoing and proposed bed-leveling fits at least one of the consultation reinitiation triggers of 50 CFR 402.16, and because new species listed since 1997 that could be affected by COE hopper dredging also trigger the need for reinitiation of consultation on the RBO.

April 30, 2007: SAD request reinitiation of the 1997 RBO.

September 12, 2008: SAD submits the South Atlantic Regional Biological Assessment for reinitiation of the RBO. SAD also states that additional information regarding modifications to seasonal hopper dredging activities will be forthcoming.

November 19, 2008: NMFS and SAD hold a conference to discuss modifications to hopper dredging windows and relocation trawling activities during which time SAD presents information and analyses supporting their request to modify the conditions of the existing RBO.

December 19, 2008: NMFS receives a request for ESA section 7 consultation from SAD for listed species potentially affected by June 1 through September 30, 2009, maintenance dredging of the Savannah, Brunswick, and Fernandina Harbor Entrance Channels. On January 15, 2009, SAD concludes that the proposed seasonal hopper dredging may affect, and is likely to adversely affect, listed marine sea turtles and shortnose sturgeon within the action area. Additionally, they conclude that the proposed project may affect, but is not likely to adversely affect, North Atlantic right whales.

2 DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

2.1 Proposed Action

During fiscal year 2009, SAD proposes to conduct seasonal maintenance dredging of the Savannah, Brunswick, and Fernandina Harbor Entrance Channels. Maintenance dredging of the channels is expected to remove approximately 500,000 cubic yards of material from the Savannah Harbor Entrance Channel, 1,000,000 cubic yards of material from the Brunswick Harbor Entrance Channel, and approximately 700,000 cubic yards of material from the Fernandina Harbor Entrance Channel. The maintenance dredging will be conducted by hopper dredge. The proposed project includes modified turtle relocation trawling activities, as well as hopper dredge windows outside of those authorized under the 1997 RBO. Specifically, SAD proposes to conduct dredging operations from June 1 through September 30, 2009. Current dredging windows authorized under the 1997 RBO are November 1 through May 31 for Savannah Harbor Entrance Channel, and December 1 through May 15 for Brunswick and Fernandina Harbor Entrance Channels. Subsequent modified bed-leveling may occur after each channel is dredged. Dredged material will be disposed of by the hopper dredge at an authorized ocean dredged material disposal site (ODMDS) offshore of each individual project site.

Modified Turtle Relocation Trawling

Relocation trawling has been successful at temporarily displacing Kemp's ridley, loggerhead, leatherback, and green sea turtles from channels in the Atlantic and Gulf of Mexico during periods when hopper dredging was imminent or ongoing. Historically, relocation trawling has been used to reduce turtle take by capturing the turtle in a modified shrimp net, bringing it onboard the trawler, and transporting it approximately 3-5 miles from the dredging where it is released into the ocean. Dickerson et al. (2007) analyzed historical data for COE dredging projects in the Atlantic and Gulf of Mexico and concluded that relocation trawling is effective at reducing the rate of sea turtle entrainment by hopper dredges. Dickerson et al. (2007) also found that the effectiveness of relocation trawling was increased: 1) when the trawling was initiated at the beginning or early in the project, and 2) by the intensity of trawling effort (i.e., more time trawling per hour). Dickerson (pers. comm. 2008) noted that when a relocation trawler is used – whether or not turtles are actually captured – the incidence of lethal sea turtle take by hopper dredges decreases. Dickerson concluded that the action of the trawl gear on the bottom results in stimulating turtles off the bottom and into the water column, where they are no longer likely to be impacted by the suction draghead of a hopper dredge. According to Dickerson et al. (2007), actual capture and physical relocation of the turtles does not appear to be necessary to reduce the risk of dredge entrainment.

During January and February 2009, modified turtle relocation trawling was conducted at Brunswick Harbor Entrance Channel using a standard trawl net with an open codend. While traditional relocation trawling was initiated on January 2, 2009, in anticipation of the channel dredging that ultimately commenced on January 5, the trawler opened the codend and started non-capture trawling on January 6. Work on the inner bar entrance channel was completed on February 22 after having removed 1.48 million cubic yards of material; two loggerhead sea turtle takes by the dredge were recorded. Dredging on the outer bar entrance channel will not commence until June, under the terms of this opinion.

For Savannah, Brunswick, and Fernandina Harbor Entrance Channels, the COE is proposing to use a modified relocation trawling approach to reduce the level of lethal sea turtle takes by the hopper dredge. A modified system employing either a standard trawl net with an open codend; a "naked rig" using only tickler chains, rollers, or other ground gear but no net; a mat constructed of rubber or other similar material; or some similar apparatus will be towed by a trawl vessel to disturb the sediment on the bottom, subsequently dispersing any turtles that may be on or in the bottom and in the dredge path. Unlike traditional relocation trawling where the turtle is handled and sampled for biological information, this approach would prevent the turtle from being captured in the net and from undergoing the stresses associated with net capture and handling. However, the proposed modified approach would still reduce the risk of injurious or lethal take by the hopper dredge's draghead. Because the modified gear would not have to be retrieved frequently to check for turtles and to release other bycatch, the amount of effective trawling time can be greatly increased. Modified (i.e., non-capture) relocation trawling will be conducted during all portions of the project when hopper dredges are used and will be operated in front of the active hopper dredge at a reasonable and safe distance.

Modified Bed-Leveling

A "bed-leveler" is considered to be any type of dragged device used to smooth sediment bottom irregularities left by a dredge. In certain cases, bed-levelers are used to redistribute sediments to maintain navigable depths rather than removing them by dredging with conventional methods. Typically, a bed-leveler consists of a large customized plow, I-beam, or old spud that is slowly dragged across the sediment to smooth out peaks and trenches during the final cleanup phase of the dredging activity. Another variant is for the hopper dredge to dig trenches along the channel below the project depth, and then a plow/I-beam bed-leveling device suspended from a barge is dragged along the bottom of the channel by a tugboat to knock material from high spots into deeper trenches dug along the channel bottom in order to achieve final project depth and an even grade.

For Savannah, Brunswick, and Fernandina Harbor Entrance Channels, the COE is proposing to use modified bed-levelers to reduce impacts on sea turtles potentially resulting from the use of this gear. Basically, standard bed-leveling equipment will be modified with various sea turtle deflector configurations similar to dredge draghead turtle deflectors.

2.2 Action Area

50 CFR 404.02 defines action area as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." The action area for the proposed action includes the 11.4- and 5-mile-long entrance channels for Savannah and Brunswick (respectively) Harbors in Georgia, and the 16-mile-long entrance channel for Fernandina Harbor in Florida. These three channels (i.e., action area) extend into the Atlantic Ocean, and are each bounded by a one-mile buffer area. Additionally, the action area includes an authorized ODMDS offshore of each proposed project site where dredged material will be disposed. Specifically, the ODMDS include:

- Savannah ODMDS: 4.26 square nautical miles in area sited approximately 4.5 nm offshore the Georgia coast, with an average depth of 11.4 m. In general, the benthos consists of predominantly sand with small amounts of gravel and silt/clay (EPA website: http://www.epa.gov/region4/water/oceans/sites.html#savannah).
- Brunswick Harbor ODMDS: approximately 2 square nautical miles in area sited approximately 6.5 nm offshore the Georgia coast, with an average depth of 9 m. In general, the benthos is dominated by sediments in the sand fraction with small percentages of both gravel and silt/clays (EPA website: http://www.epa.gov/region4/water/oceans/sites.html#savannah).
- Fernandina Beach ODMDS: 4 square-miles in area sited approximately 5.5 nm offshore the Florida coast, with an average depth of 16 m. In general, the benthos is dominated by sandy sediments (EPA Web site: http://www.epa.gov/region4/water/oceans/sites.html#savannah).

3 STATUS OF LISTED SPECIES AND CRITICAL HABITAT

The following endangered (E) and threatened (T) species under the jurisdiction of NMFS may occur in the action area:

Common Name	**Scientific Name**	**Status**
Sea Turtles		
Loggerhead sea turtle	*Caretta caretta*	T
Green sea turtle	*Chelonia mydas*	E/T[1]
Kemp's ridley sea turtle	*Lepidochelys kempii*	E
Leatherback sea turtle	*Dermochelys coriacea*	E
Fish		
Shortnose sturgeon	*Acipenser brevirostrum*	E
Whales		
North Atlantic right whale	*Eubalaena glacialis*	E
Humpback whale	*Megaptera novaeangliae*	E

Critical Habitat

There is currently no designated critical habitat in the action area. Based on the 2006 re-listing of separate right whale species in the northern Pacific and northern Atlantic oceans, NMFS is in the process of re-designating critical habitat for the North Atlantic right whale.

3.1 Species Not Likely to Be Adversely Affected

Leatherback Sea Turtle

Leatherback sea turtles may be found in the action area, particularly when onshore winds and/or currents push jellyfish, their preferred prey, close inshore. However, leatherbacks are primarily a

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

pelagic species, preferring deeper, offshore waters than those of the action area. Furthermore, in over 20 years of NMFS consultations with the COE and other federal agencies (including the U.S. Navy and the Minerals Management Service) on hopper dredging projects carried out in both the South Atlantic and the Gulf of Mexico, there has never been a documented take of a live leatherback sea turtle by a hopper dredge. Because of this and their very large size (compared to hopper dredge dragheads), pelagic (surface and mid-water) feeding habits (which make it unlikely they would ever encounter a bottom-hugging hopper dredge draghead), and unlikely presence in the action area, NMFS believes the possibility that they would be adversely affected by a hopper dredge is discountable.

Shortnose Sturgeon

Shortnose sturgeon inhabit rivers and estuaries. It is an anadromous fish that spawns in the coastal rivers along the east coast of North America from the St. John River in Canada, to the St. Johns River in Florida. In the southern portion of the range, they are found in the St. Johns River in Florida, and the Altamaha, Ogeechee, and Savannah Rivers in Georgia; shortnose sturgeon prefer nearshore marine, estuarine, and riverine habitat of these large river systems. The species is significantly more common in northern portions of its range than it is in the south. While adult shortnose sturgeon may occasionally be found in marine waters during the summer, the species typically is found in more estuarine waters, and in rivers near the saltwater-freshwater interface. Therefore, because the proposed action takes place in marine waters and farther offshore of where shortnose sturgeon typically are found, and due to the species' general rarity in the southern portions of its range, NMFS concludes that the project's effects on shortnose sturgeon are discountable.

North Atlantic Right Whale

The nearshore waters of northeast Florida and southern Georgia were first identified as a likely calving and nursery area for right whales in 1984. While sightings off Georgia and Florida include primarily adult females and calves, juveniles and adult males have also been observed. Annual right whale migration through Georgia and Florida offshore waters occurs from November 1 through April 30. As the species is not expected to occur near the action area during the time period of the proposed project (i.e., June 1 through September 30, 2009), NMFS concludes that the project's effects on North Atlantic right whales are discountable.

Humpback Whale

Humpback whales occur in waters under U.S. jurisdiction throughout the year. Migrations occur annually between their summer and winter ranges. The summer range for the Western North Atlantic stock includes the Gulf of Maine, Canadian Maritimes, western Greenland, and the Denmark Strait. As the species is not expected to occur near the action area during the time period of the proposed project (i.e., June 1 through September 30, 2009), NMFS concludes that the project's effects on humpback whales are discountable.

Summary

For the reasons discussed above, NMFS has determined that leatherback sea turtles, shortnose sturgeon, as well as North Atlantic right and humpback whales are not likely to be adversely affected by the proposed action; therefore, these species will not be considered further in this opinion.

3.2 Status of Species Likely to be Adversely Affected

The following sea turtle subsections focus primarily on the Atlantic Ocean populations of these species since these are the populations that may be directly affected by the proposed action; as sea turtles are highly migratory, potentially affected species in the action area may make migrations in other areas of the Gulf of Mexico, Atlantic Ocean, and Caribbean Sea. Therefore, the range-wide status of the species described below also best reflects each species' status within the action area. Furthermore, these species are listed as global populations (with the exception of Kemp's ridley and Florida green sea turtles, whose distribution is entirely in the Atlantic including the Gulf of Mexico). The global status and trends of these species are included as well, in order to provide a basis for our final determination of the effects of the proposed action on the species as listed under the ESA.

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 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 (>2,000 nesting females) populations 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 fibropapilloma (NMFS and USFWS 1998a; NMFS 2004a).

Hawaii green turtles are genetically distinct and geographically isolated, and the population appears to be increasing in size despite the prevalence of fibropapilloma and spirochidiasis (Aguirre et al. 1998). 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: Michoacan, 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 Michoacan, 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. The status of at least a few of the non-Hawaiian nesting stocks in the Pacific recently was found to also 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 U.S. 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.

Some of the principal feeding pastures in the western Atlantic Ocean include the upper west coast of Florida and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito and Indian River Lagoon systems and near-shore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the "Mosquito Coast" of Nicaragua, the Caribbean coast of Panama, and scattered areas along Colombia and Brazil (Hirth 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).

Population Dynamics and Status

The vast majority of green sea turtle nesting within the southeastern U.S. 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 five-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 (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 of 17,402-37,290 females per year (NMFS and USFWS 2007a). The number of females nesting per year on beaches in the Yucatán, at 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 20 years of regular monitoring since establishment of the index beaches in 1989; this pattern could be a result of 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). 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 estimated annual growth rate of 13.9 percent for the Florida nesting stock at the Archie Carr National Wildlife Refuge, and 4.9 percent annual growth for the Tortuguero, Costa Rica population.

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 in St. Lucie County, Florida, show that the annual number of immature green sea turtles captured has increased significantly in the past decades. The power plant averaged 215 green sea turtle captures per year from 1977 to 2002 with an increasing trend over that time (FPL 2002), and in the five years from 2002-2006, the average was 333 green turtles per year with a high of 427 and a low of 267 captures (FPL and Quantum Resources 2007). 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 (www.epa.gov/climatechange/index.html) provides basic background information on these and other measured or anticipated effects. However, the impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty.

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

The Kemp's ridley was listed as endangered on December 2, 1970. Internationally, the Kemp's ridley is considered the most endangered sea turtle (Zwinenberg 1977; Groombridge 1982; TEWG 2000). Kemp's ridleys nest primarily at Rancho Nuevo, a stretch of beach in Mexico, Tamaulipas State. 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 Kemp's 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 increased from 7,147 in 2004, to 10,099 in 2005, to 12,143 in 2006, to 15,032 during the 2007 nesting season (Gladys Porter Zoo 2007). A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 128 in 2007 (National Park Service data 2007)

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 breeding females 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, 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 (www.epa.gov/climatechange/index.html) provides basic background information on these and other measured or anticipated effects. 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 25º-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward a higher numbers of females (NMFS and USFWS 2007c).

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

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

3.2.2.2 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 has steadily increased since the late 1980s. Nesting data has exceeded 12,000 nests per year from 2004-2007 (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 nonbreeding 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 rebound. Many threats to the future of the species remain, including interactions with fishery gear, marine pollution, foraging habitat destruction, illegal poaching of nests and potential threats to the nesting beaches from such sources as global climate change, development, and tourism pressures.

3.2.3 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, U.S.), 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.

3.2.3.1 Pacific Ocean

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

Pacific loggerhead turtles are captured, injured, or killed in numerous Pacific fisheries including Japanese longline fisheries in the western Pacific Ocean and South China Seas; direct harvest and commercial fisheries off Baja California, Mexico; commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet fisheries. In Australia, where turtles are taken in bottom trawl and longline fisheries, efforts have been made to reduce fishery bycatch (NMFS and USFWS 2007e).

Additionally, 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 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.

3.2.3.2 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 at Masirah, the largest nesting site within Oman, each year (Baldwin et al. 2003). In the eastern Indian Ocean, all known nesting sites are found in Western Australia (Dodd 1988). As has been found in other areas, nesting numbers are disproportionate within the area with the majority of nesting occurring at a single location. This may, however, be the result of fox predation on eggs at other Western Australia nesting sites (Baldwin et al. 2003).

3.2.3.3 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).

3.2.3.4 Atlantic Ocean

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. Previous section 7 analyses have recognized at least five western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29ºN; (2) a south Florida nesting subpopulation, occurring from 29ºN on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez 1990 and TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS SEFSC 2001). The recently published Recovery Plan for the northwest Atlantic population of loggerhead sea turtles concluded, based on recent advances in genetic analyses, that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula, and that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the Plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are: 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.

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 U.S. 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 of North Carolina where water temperature is influenced by the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to immigrate to North Carolina inshore waters (e.g., Pamlico and Core Sounds) and also move up the coast (Epperly et al. 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 (≥11°C) (Epperly et al. 1995a-c). Loggerhead sea turtles are year-round residents of central and south Florida.

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

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

Population Dynamics and Status

A number of stock assessments and similar reviews (TEWG 1998, TEWG 2000, NMFS SEFSC 2001, Heppell et al. 2003, NMFS and USFWS 2008) 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 has led to the conclusion that the observed decline in nesting 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, North Carolina 841 loggerhead nests were observed compared to the 10-year average of 715 nests. In South Carolina, 2008 had the seventh highest year on record since 1980, with 4,500 nests, but this did not change the long-term trend line indicating a decline on South Carolina beaches. Georgia beach surveys located a total of 1,648 nests in 2008. This number surpassed the previous statewide record of 1,504 nests in 2003. According to analyses by Georgia DNR the 40-year time-series trend data 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 time frame has found opposing sex ratios (Wyneken et al. 2004) so further information is needed to clarify the issue. Since nesting female loggerhead sea turtles exhibit nest fidelity, the continued existence of the Northern subpopulation is related to the number of female hatchlings that are produced. Producing fewer females will limit the number of subsequent offspring produced by the subpopulation.

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

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. Bresette pers. comm. regarding captures at the St. Lucie Power Plant; SCDNR unpublished SEAMAP-SA data; Epperly et al. 2007). Ehrhart et al. (2007) found no significant regression-line trend in the long-term dataset. However, notable increases in recent years and a statistically significant increase in CPUE of 102.4 percent from the four-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 U.S. in the recent past. 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. NMFS convened a new Turtle Expert Working Group 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. A final report by the loggerhead TEWG is expected in 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 a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the benthic environment, and in the pelagic environment. Hurricanes are particularly destructive to sea turtle nests. Sand accretion and rainfall that result from these storms as well as wave action can appreciably reduce hatchling success. For example, in 1992, all of the eggs over a 90-mile length of coastal Florida were destroyed by storm surges on beaches that were closest to the eye of Hurricane Andrew (Milton et al. 1994). Also, many nests were destroyed during the 2004 and 2005 hurricane seasons. Other sources of natural mortality include cold stunning and biotoxin exposure.

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

Loggerhead sea turtles are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development, and transportation, marine pollution, underwater explosions, hopper dredging, offshore artificial lighting, power plant entrainment and/or impingement, entanglement in debris, ingestion of marine debris, marina and dock construction and operation, boat collisions, poaching, and fishery interactions. Loggerheads in the pelagic environment are exposed to a series of longline fisheries, which include the HMS Atlantic pelagic longline fisheries, an Azorean longline fleet, a Spanish longline fleet, and various longline fleets in the Mediterranean Sea (Aguilar et al. 1995, Bolten et al. 1994, Crouse 1999b). Loggerheads in the benthic environment in waters off the coastal U.S. are exposed to a suite of fisheries in federal and state waters including trawl, purse seine, hook-and-line, gillnet, pound net, longline, and trap fisheries. The sizes and reproductive values of sea turtles taken by fisheries vary significantly, depending on the location and season of the fishery, and size-selectivity resulting from gear characteristics. Therefore, it is possible for fisheries that interact with fewer, more reproductively valuable turtles to have a greater detrimental effect on the population than one that takes greater numbers of less reproductively valuable turtles if the fishery removes a higher overall reproductive value from the population (Wallace et al. 2008). Attaining a more thorough understanding of the characteristics, as well as the quantity, of sea turtle bycatch across all fisheries is of great importance.

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 percent 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, for the most part, be predicted with any degree of certainty.

The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts may have significant impacts to the hatchling sex ratios of loggerhead sea turtles (NMFS and USFWS 2007e). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25º-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward 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 overwash (NMFS and USFWS 2007e). Sea level rise from global climate change (IPCC 2007) is also a potential problem, particularly for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

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

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

3.2.3.3 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. 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 will complete the petition findings and plan of action by May 1, 2009.

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

4 ENVIRONMENTAL BASELINE

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

4.1 Status of Sea Turtles in the Action Area

Sea turtles found in the immediate project area may travel widely throughout the Atlantic, Gulf of Mexico, and Caribbean Sea, and individuals found in the action area can potentially be affected by activities anywhere within this wide range. Thus, the status of the species in the action area is the same as the species' range-wide status discussed in Section 3 above.

4.2 Federal Actions

In recent years, NMFS has undertaken several ESA section 7 consultations to address the effects of federal actions on sea turtles, including green, Kemp's ridley, and loggerhead sea turtles, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to develop ways of reducing the probability of adverse effects of the action on sea turtles. Similarly, NMFS has undertaken recovery actions under the ESA and is addressing the problem of take of sea turtles in the fishing industry and other activities such as COE dredging operations. The summary below of sources of incidental take of sea turtles includes only those federal actions in the South Atlantic which have already concluded or are currently undergoing formal section 7 consultation.

Vessel and Military Operations
Potential sources of adverse effects from federal vessel operations in the action area include operations of the U.S. Department of Defense (DOD), Navy (USN), Air Force and Coast Guard (USCG), the Environmental Protection Agency, the National Oceanic and Atmospheric Administration (NOAA), and the COE. NMFS has conducted formal consultations with the USCG, the USN, and NOAA on some of 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; NMFS 1996; NMFS 1998) and the USN (NMFS 1997a; 2009) for details on the scope of vessel operations for these agencies and conservation measures being implemented as standard operating procedures. The current USN biological opinion for

Mayport (NMFS 2009) authorizes the (lethal) take of up to 17 loggerhead, 3 green, and 2 Kemp's ridley sea turtles during the proposed project.

Since the 2009 USN consultation only covered operations out of Mayport, Florida, potential still remains for USN vessels to adversely affect sea turtles within the action area. 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.

Dredging
The construction and maintenance of federal navigation channels and sand mining ("borrow") areas using hopper dredges has been identified as a source of sea turtle mortality. Hopper dredges move relatively rapidly (compared to sea turtle swimming speeds) and can entrain and kill sea turtles as the drag arm of the moving dredge overtakes the slower-moving or stationary sea turtle. The COE has biological opinions from NMFS covering the use of hopper dredges in the Atlantic and Gulf of Mexico. Along the Atlantic coast of the southeastern United States (North Carolina through Florida), the COE's current biological opinion authorizes annual take of up to 35 loggerheads, 7 greens, 7 Kemp's ridleys, and 2 hawksbill sea turtles from hopper dredging activities (NMFS 1997b). Consultation has been reinitiated on this opinion due to the listing of new species and designation of critical habitat.

ESA Permits
The ESA allows the issuance of permits to take ESA-listed species for the purposes of scientific research (section 10(a)(1)(A)). In addition, the ESA allows for NMFS to enter into cooperative agreements with states developed under section 6 of the ESA, to assist in recovery actions of listed species. Prior to issuance of these authorizations, the proposal must be reviewed for compliance with section 7 of the ESA.

Sea turtles are the focus of research activities authorized by a section 10 permit under the ESA. Authorized activities range from photographing, weighing, and tagging sea turtles incidentally taken in fisheries, blood sampling, tissue sampling (biopsy), and performing laparoscopy on intentionally captured turtles. The number of authorized takes varies widely depending on the research and species involved but may involve the taking of hundreds of 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 be reviewed for compliance with section 7(a)(2) of the ESA to ensure that issuance of the permit does not result in jeopardy to the species.

Federally-Managed Fisheries
Threatened and endangered sea turtles are adversely affected by several types of fishing gears used throughout the action area. Gillnet, longline, vertical hook-and-line gear, trawl gear, and pot/trap 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 a fishery

management plan (FMP), or for which any federal action is taken to manage that fishery, impacts have been evaluated under section 7. Formal section 7 consultation conducted on the following fisheries, occurring at least in part within the action area, were found likely to adversely affect threatened and endangered sea turtles: coastal migratory pelagics, dolphin-wahoo, South Atlantic snapper-grouper, Southeastern shrimp, and Atlantic HMS fisheries (i.e., swordfish, tuna, shark, and billfish). An Incidental Take Statement (ITS) has been issued for the take of sea turtles in each of these fisheries. Authorized takes of listed species are described in Appendix 4.

NMFS recently completed a section 7 consultation on the continued authorization of the coastal migratory pelagics fishery in the Gulf of Mexico and South Atlantic (NMFS 2007). In the Gulf of Mexico, hook-and-line, gillnet, and castnet 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 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 conducted a section 7 consultation to consider the effects of the dolphin-wahoo fishery on sea turtles under the original FMP (NMFS 2003e). The August 27, 2003, opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by the longline component of the fishery, but it was not expected to jeopardize their continued existence. An ITS for sea turtles was provided with the opinion. Also, pelagic longline vessels can no longer target dolphin or wahoo with smaller hooks because of hook size requirements in the pelagic longline fishery.

A section 7 consultation on the South Atlantic snapper-grouper fishery (NMFS 2006) has also recently been completed by NMFS. The fishery uses spear and powerhead, pots (i.e., traps), longline, and vertical hook-and-line gear. The opinion determined that only longline and vertical hook-and-line gear is 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.

On December 2, 2002, NMFS completed the biological opinion for the Southeast shrimp trawl fishery (NMFS 2002a) 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. Several management actions have been implemented under both the Gulf of Mexico and South Atlantic shrimp FMPs in recent years, but none have required reinitiation of consultation on the 2002 opinion.

Atlantic HMS fisheries 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. The Northeast swordfish driftnet portion of the fishery was prohibited during an emergency closure that began in December 1996, and was subsequently extended. A permanent prohibition on the use of driftnet gear in the swordfish fishery was published in 1999. 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 recently completed a section 7 consultation on the continued authorization of HMS Atlantic shark fisheries (NMFS 2008). The commercial sector uses bottom longline and gillnet gear, while the recreational sector only uses 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 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.

4.3 State or Private Actions

Vessel Traffic

Commercial traffic and recreational pursuits can adversely affect sea turtles through propeller and boat strikes. However, the threat is not constant and is influenced by vessel type, vessel speed, and environmental conditions such as sea state and visibility. Given these variables, it is difficult to definitively evaluate potential risk to sea turtles stemming from specific vessel traffic. This difficulty is compounded by a general lack of information on vessel use trends, particularly in regard to offshore vessel traffic.

The Sea Turtle Stranding and Salvage Network (STSSN) includes many records of vessel interaction (crush and/or propeller injury) with sea turtles. The STSSN has documented 25,290 Florida stranding records (all species and size classes) in their database from 1980 through 2008. The strandings records include all causes of mortality, such as disease, hopper dredge impacts, hypothermic stunning, interactions with fisheries, interactions with pollution, and vessel strikes. However, due to the condition of stranded turtles in many cases (i.e., decomposition), it was impossible to definitively determine actual cause of mortality for 70 percent of the specimens. In addition, it was not possible to determine in many cases whether the vessel strike occurred before or after the turtle’s death. Additionally, it should be noted that many turtles killed by anthropogenic causes will not show up in the strandings database, as the mortality event may occur far offshore or the damage to the turtle is so significant the carcass sinks, preventing the turtle from washing ashore. This point is important to remember when considering apparent geographical trends in the data, which may be an artifact of other factors rather than increased mortality risk in one area versus another. For example, turtles injured/killed in Monroe and Miami-Dade Counties may potentially be more well-represented in the strandings data due to bathymetric constraints that concentrate both turtles and vessel traffic relatively close to shore when compared to other counties with a broader continental shelf, where turtles may not wash up and be documented in the database. Additionally, stranding information does not indicate where

a potential mortality event (e.g., vessel strike) occurred, as a turtle could have been injured/killed at one location and then drifted with currents (i.e., generally northward with the Gulf Stream on the east coast) for a considerable distance before coming ashore.
Given the variables described above, though there are numerous strandings of turtles indicating vessel strike impacts each year, the exact extent of the vessel traffic impact on sea turtles is not quantifiable at this time.

State Fisheries
Recreational fishing from private vessels and from shore occurs in the area. Observations of Florida recreational fisheries have shown that loggerhead, leatherback, and green sea turtles are known to take baited hooks, and loggerheads frequently ingest the hooks. Hooked turtles have been reported by the public fishing from boats, piers, and beach, banks, and jetties and from commercial fishermen fishing for reef fish and for sharks with both single rigs and bottom longlines (NMFS 2001b). Additionally, lost fishing gear such as line cut after snagging on rocks, or discarded hooks and line, can also pose an entanglement threat to sea turtles in the area. A detailed summary of the known impacts of hook-and-line incidental captures to loggerhead sea turtles can be found in the TEWG reports (1998; 2000). In August of 2007, NMFS issued a regulation (72 FR 43176, August 3, 2007) to require any fishing vessels subject to the jurisdiction of the United States to take observers upon NMFS' request. The purpose of this measure is to learn more about 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.

4.4 Other Potential Sources of Impacts in the Environmental Baseline

A number of activities that may indirectly affect listed species in the action area of this consultation include ocean dumping and disposal, aquaculture, and anthropogenic marine debris. The impacts from these activities are difficult to measure. Where possible, conservation actions are being implemented to monitor or study impacts from these sources. Close coordination is occurring through the section 7 process on both dredging and disposal sites to develop monitoring programs and ensure that vessel operators do not contribute to vessel-related impacts.

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

Acoustic Impacts
Acoustic impacts can include temporary or permanent injury, habitat exclusion, habituation, and disruption of other normal behavior patterns. Although focused on marine mammals, sea turtles may benefit from increased research on acoustics and reduction in noise levels.

4.4 Conservation and Recovery Actions Shaping the Environmental Baseline

NMFS has implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial fisheries. In particular, NMFS has required the use of TEDs in southeast U.S. shrimp trawls since 1989. It has been estimated that TEDs exclude 97 percent of the sea turtles caught in such trawls. These regulations have been refined over the years to ensure that TED effectiveness is maximized through proper placement and installation, configuration (e.g., width of bar spacing), floatation, and more widespread use. Analyses by Epperly and Teas (2002) indicated that the minimum requirements for the escape opening dimensions in TEDs in use at that time were too small, and that as many as 47 percent of the loggerheads stranding annually along the Atlantic Seaboard and Gulf of Mexico were too large to fit through existing openings. On February 21, 2003, NMFS published a final rule to require larger escape openings in TEDs used in the Southeast shrimp trawl fishery (68 FR 8456, February 21, 2003). Based upon the analyses in Epperly et al. (2002), leatherback and loggerhead sea turtles will greatly benefit from the new regulations, with expected reductions of 97 percent and 94 percent, respectively, in mortality from shrimp trawling. Several states (e.g., Florida, Georgia, South Carolina, Texas) have regulations requiring the use of TEDs in state-regulated shrimp trawl fisheries, and the federal regulations also apply in state waters.

NMFS has also been active in public outreach efforts to educate fishermen regarding sea turtle handling and resuscitation techniques. There is also an extensive network of STSSN participants along the Atlantic and Gulf of Mexico coasts who not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded sea turtles.

Loggerheads, leatherbacks, greens, and Kemp's ridleys are known to bite a baited hook, frequently ingesting the hook. Hooked turtles have been reported by the public fishing from boats, piers, beaches, banks, and jetties. Necropsies have revealed hooks internally, which often were the cause of death. In 2006, the Marine Recreational Fishery Statistics Survey (MRFSS) added a survey question regarding sea turtle interactions within recreational fisheries; NMFS is exploring potential revisions to MRFSS to quantify recreational encounters with sea turtles on a permanent basis. Detailed summaries of the impact of hook-and-line incidental captures on loggerhead sea turtles can be found in the TEWG reports (1998; 2000).

The recovery plans for Kemp's ridley sea turtles is in the process of being updated, and a revised plan has recently been published for the northwest Atlantic population of loggerhead sea turtles. 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, 2008).

5 EFFECTS OF THE ACTION

In this section of the opinion, we assess the effects of the proposed action on loggerhead, green, and Kemp's ridley sea turtles within the action area. The analysis in this section forms the foundation for our jeopardy analysis in Section 7. A jeopardy determination is reached if we would reasonably expect the proposed action to cause reductions in numbers, reproduction, or distribution that would appreciably reduce listed species' likelihood of surviving and recovering in the wild.

5.1 Dredging

The potential for adverse effects of dredging operations on sea turtles has been previously assessed by NMFS (NMFS 1991; 1995; 1997a; 1997b; 2003b) in the various versions of the SAD RBO and the 2003 (revised in 2005 and 2007) Gulf of Mexico RBO. Additionally, the COE has recently prepared a comprehensive analysis of data from Gulf and Atlantic hopper dredging projects to identify factors affecting sea turtle take rates (Dickerson et al. 2007; Dickerson et al. 2008). Furthermore, the COE maintains an on-line Sea Turtle Data Warehouse (COE 2009) with historical records of dredging projects and turtle interactions. These are the primary sources, discussed further below, for our analysis of dredging effects on sea turtles.

Hopper Dredging
Hopper dredging was implicated in the mortality of South Atlantic endangered and threatened sea turtles as early as the late 1970s and in NMFS' opinions issued in 1979, 1980, and others leading to the RBO issued in 1991. This determination was repeated in the 1995 and 1997 SAD RBOs (NMFS 1995; 1997a; 1997b). The measures established in consecutive RBOs (NMFS 1991; 1995; 1997a) to avoid and minimize sea turtle interactions during hopper dredging operations permitted by the COE in the southeast United States are included in this project, with the exception of modifications to dredge timing (i.e., "dredging window") and conditions of/requirements for capture-type relocation trawling.

To date, use of hopper dredges in COE activities in northeast Florida and Georgia has been limited under the 1997 RBO to operating between December 1 through April 15, except in emergency situations, due to the presumption that the potential for lethal and injurious take of sea turtles by hopper dredges would be lower during winter periods of lower seasonal abundance. However, recent data analysis of hopper dredging projects from 1995-2008 by the COE indicates that documented sea turtle take rates in projects from Georgia and the east coast of Florida are lower (on both a turtles-taken-per-project basis and turtles-taken-per-day basis) during May through November (when hopper dredging is discouraged) than during December through April, which is the NMFS-recommended dredging window (Dickerson et al. 2008). Turtles are typically more abundant during the warm summer months but may not spend large amounts of time on or in the bottom sediments and may need to surface more often to breathe due to increased activity. Turtles resting on or in bottom sediments are more vulnerable to dredge entrainment than turtles swimming in the water column above the draghead. Although increased numbers of sea turtles are known to be found between June and September (peak nesting season), they may be less vulnerable to entrainment because of their biological requirements (e.g., reproductive activities, reduced feeding, increased metabolism), mandating them to spend more time in the upper water column. Given this evidence and rationale, hopper dredging conducted during June through September with protective measures in place should result in sea turtle take rates similar to, or less than, take rates during the winter dredging windows.

To calculate the expected rates of turtle entrainment in hopper dredging for this project, NMFS consulted the Sea Turtle Data Warehouse (COE 2009) to find the most applicable historic dredging information for the Savannah, Brunswick, and Fernandina Harbor Entrance Channels.

Savannah Harbor Entrance Channel
On average from 2000-2007 (Table 1), maintenance dredging of the Savannah Harbor Entrance Channel generated just over 750,000 cubic yards of material (446,850 – 1,279,900) and resulted in 1.25 sea turtle takes (0 – 4; dredging in 2006 was shut down after dredging only 88,194 cubic yards due to sea turtle takes). Based on this information, dredging of the Savannah Harbor Entrance Channel from 2000-2007 has resulted in one sea turtle take, on average, per removal of approximately 600,000 cubic yards of material.

YEAR	QUANTITY OF DREDGED MATERIAL (CUBIC YARDS)	TURTLE TAKES	RELOCATION TRAWLING
2000	1,279,900	2 (1 loggerhead; 1 Kemp's)	N/N
2001	1,117,900	2 loggerhead	N/N
2002	446,850	2 loggerhead	N/N
2003	635,163	0	N/N
2004	620,642	0	N/N
2005	888,100	0	N/N
2006	88,194	4 (3 Kemp's; 1 loggerhead)	N/Y
2007	973,463	0	Y/Y
2008	-	-	
AVERAGE	756,277	1.25	-

Table 1. Dredged material removed and sea turtle takes during dredging of the Savannah Harbor Entrance Channel, 2000-2008 (COE Sea Turtle Data Warehouse 2009). The two entries in the relocation trawling column reflect pre-dredge relocation trawling and concurrent (to dredging operations) relocation trawling.

This average would translate into an expected take of 1-2 turtles (either loggerhead or Kemp's ridley sea turtles based on species composition of reported takes in previous Savannah Harbor dredging projects) during the course of the proposed dredging of the Savannah Harbor Entrance Channel. However, as evident in Table 1, significant variations in turtle take rates per cubic yard of dredged material removed can occur from year to year. Therefore, on a per project basis, potentially as many as 4 turtles could be taken during the proposed dredging project. Additionally, NMFS believes dredged material screening is only partially effective, and observed takes likely provide only partial estimates of total sea turtle mortality. Some turtles taken by hopper dredges may go undetected because body parts are forced through the sampling screens by water pressure and are buried in the dredged material, or animals are crushed or killed but their bodies or body parts are not entrained by the suction and so the takes may go unnoticed. The only mortalities that are documented are those where body parts float, are large enough to be caught in the screens, and can be identified as sea turtle parts. In the Gulf of Mexico RBO

(NMFS 2003b), NMFS estimated that up to one out of two impacted turtles may go undetected; however, that assumption was based on dredging during seasonal windows when no observers are required and 50 percent observer coverage on sand borrow projects. The proposed June 1 through September 31, 2009, dredging of the Savannah Harbor Entrance Channel will include 100 percent observer coverage for the duration of work. Therefore, this opinion estimates that observers will detect and record approximately 66 percent of total mortality, resulting in an additional estimated 2.06 turtles taken, but not detected, for a total of 6.06 sea turtles taken by hopper dredges during dredging of the Savannah Harbor Entrance Channel.

Brunswick Harbor Entrance Channel

On average from 2000-2008 (Table 2), maintenance dredging of the Brunswick Harbor Entrance Channel generated just over 1.3 million cubic yards of material (57,507 – 3,111,330) and resulted in 2.5 sea turtle takes (0 – 6; the second dredging session in 2005 and dredging in 2008 were discarded in the average due to unavailable dredged material amounts). Based on this information, dredging of the Brunswick Harbor Entrance Channel from 2000-2008 has resulted in one sea turtle take, on average, per removal of approximately 540,000 cubic yards of material.

YEAR	QUANTITY OF DREDGED MATERIAL (CUBIC YARDS)	TURTLE TAKES	RELOCATION TRAWLING
2000	1,332,000	6 loggerhead	N/Y
2001	1,459,630	0	N/N
2002	584,075	2 loggerhead	N/N
2003	3,111,330	2 loggerhead	Y/Y
2004	2,091,300	3 (2 Kemp's; 1 loggerhead)	N/Y
2005	966,000 N/A	1 loggerhead 0	N/N N/Y
2006	57,507	0	N/N
2007	1,198,571	6 (3 loggerhead; 3 Kemp's)	Y/Y
2008	N/A	5 (3 loggerhead; 2 Kemp's)	Y/Y
AVERAGE	1,350,052	2.5	-

Table 2. Dredged material removed and sea turtle takes during dredging of the Brunswick Harbor Entrance Channel, 2000-2008 (COE Sea Turtle Data Warehouse 2009). The two entries in the relocation trawling column reflect pre-dredge relocation trawling and concurrent (to dredging operations) relocation trawling.

This average would translate into an expected take of 2-3 turtles (either loggerhead or Kemp's ridley sea turtles based on species composition of reported takes in previous Brunswick Harbor dredging projects) during the course of the proposed dredging of the Brunswick Harbor Entrance Channel. However, as evident in Table 2, significant variations in turtle take rates per cubic yard of dredged material removed can occur from year to year. Therefore, on a per project basis, potentially as many as 6 turtles could be taken during the proposed dredging project. Additionally, NMFS believes dredged material screening is only partially effective, and observed takes likely provide only partial estimates of total sea turtle mortality. Some turtles taken by hopper dredges may go undetected because body parts are forced through the sampling screens by water pressure and are buried in the dredged material, or animals are crushed or killed but their bodies or body parts are not entrained by the suction and so the takes may go unnoticed. The only mortalities that are documented are those where body parts float, are large enough to be caught in the screens, and can be identified as sea turtle parts. In the Gulf of Mexico RBO (NMFS 2003b), NMFS estimated that up to one out of two impacted turtles may go undetected; however, that assumption was based on dredging during seasonal windows when no observers are required and 50 percent observer coverage on sand borrow projects. The proposed June 1 through September 31, 2009, dredging of the Brunswick Harbor Entrance Channel will include 100 percent observer coverage for the duration of work. Therefore, this opinion estimates that observers will detect and record approximately 66 percent of total mortality, resulting in an additional estimated 3.09 turtles taken, but not detected, for a total of 9.09 sea turtles taken by hopper dredges during dredging of the Brunswick Harbor Entrance Channel. This estimate is based on the implementation of modified turtle relocation trawling to prevent additional lethal takes by hopper dredges; in the complete absence of modified turtle relocation trawling, takes by hopper dredges could be higher.

Fernandina Harbor Entrance Channel
On average from 2000-2008 (Table 3), maintenance dredging of the Fernandina Harbor Entrance Channel generated just over 785,000 cubic yards of material (500,000 – 1,870,490) and resulted in 2.1 sea turtle takes (0 – 6). Based on this information, dredging of the Fernandina Harbor Entrance Channel from 2000-2008 has resulted in one sea turtle take, on average, per removal of approximately 374,000 cubic yards of material.

YEAR	QUANTITY OF DREDGED MATERIAL (CUBIC YARDS)	TURTLE TAKES	RELOCATION TRAWLING
2000	951,785	4 (3 loggerhead; 1 Kemp's)	N/Y
2001	667,747	0	N/Y
2002	812,722	6 (4 Kemp's; 2 loggerhead)	N/Y
2003	537,072	0	N/Y
2004	1,870,490	2 loggerhead	N/Y
2005	536,000	0	N/N
2006	500,000	3 (2 loggerhead; 1 Kemp's)	N/N
2007	649,623	1 loggerhead	N/N
2008	540,433	3 (2 green; 1 loggerhead)	N/Y
AVERAGE	785,097	2.1	-

Table 3. Dredged material removed and sea turtle takes during dredging of the Fernandina Harbor Entrance Channel, 2000-2008 (COE Sea Turtle Data Warehouse 2009). The two entries in the relocation trawling column reflect pre-dredge relocation trawling and concurrent (to dredging operations) relocation trawling.

This average would translate into an expected take of 2 turtles (either loggerhead or Kemp's ridley sea turtles based on species composition of reported takes in previous Fernandina Harbor dredging projects) during the during the course of the proposed dredging of the Fernandina Harbor Entrance Channel. However, as evident in Table 3, significant variations in turtle take rates per cubic yard of dredged material removed can occur from year to year. Therefore, on a per project basis, potentially as many as 6 turtles could be taken during the proposed dredging project. Additionally, NMFS believes dredged material screening is only partially effective, and observed takes likely provide only partial estimates of total sea turtle mortality. Some turtles taken by hopper dredges may go undetected because body parts are forced through the sampling screens by water pressure and are buried in the dredged material, or animals are crushed or killed but their bodies or body parts are not entrained by the suction and so the takes may go unnoticed. The only mortalities that are documented are those where body parts float, are large enough to be caught in the screens, and can be identified as sea turtle parts. In the Gulf of Mexico RBO (NMFS 2003b), NMFS estimated that up to one out of two impacted turtles may go undetected; however, that assumption was based on dredging during seasonal windows when no observers are required and 50 percent observer coverage on sand borrow projects. The proposed June 1 through September 31, 2009, dredging of the Fernandina Harbor Entrance Channel will include 100 percent observer coverage for the duration of work. Therefore, this opinion estimates that observers will detect and record approximately 66 percent of total mortality, resulting in an additional estimated 3.09 turtles taken, but not detected, for a total of 9.09 sea turtles taken by hopper dredges during dredging of the Fernandina Harbor Entrance Channel. This estimate is based on the implementation of modified turtle relocation trawling to prevent additional lethal takes by hopper dredges; in the complete absence of modified turtle relocation trawling, takes by hopper dredges could be higher.

The species observed taken in the 2000-2008 dredging projects for the Savannah, Brunswick, and Fernandina Harbor Entrance Channels were almost entirely loggerhead and Kemp's ridley, though a few green sea turtles were taken at Fernandina (a total of 35 loggerhead, 17 Kemp's ridley, and 2 green sea turtles). As detailed above, the three proposed dredging projects may potentially take a combined total of 24 sea turtles. Using the species composition observed in the 2000-2008 dredging projects, of the 24 sea turtles estimated to be taken in the proposed Savannah, Brunswick, and Fernandina Harbor Entrance Channel dredging projects, 16 will be loggerhead sea turtles, 7 will be Kemp's ridley sea turtles, and 1 will be a green sea turtle. Some turtles survive entrainment in hopper dredges, usually with serious injuries; however this is extremely rare and almost all observed takes have been lethal. Therefore, to be conservative, we are predicting that all takes by hopper dredges are likely to be lethal.

5.2 Modified Bed-Leveling Activities

Bed-leveling is often associated with hopper dredging (and other types of dredging) operations. Bed-leveling "dredges" do not use suction. They redistribute sediments, rather than removing them. Plows, I-beams, or other seabed-leveling mechanical dredging devices are often used to lower high spots left in channel bottoms and dredged material deposition areas by hopper dredges or other type dredges. Leveling devices typically weigh about 30 to 50 tons, are fixed with cables to a derrick mounted on a barge pushed or pulled by a tugboat at about one to two knots. Some evidence indicates that bed-leveling devices may be responsible for occasional sea turtle mortalities (NMFS 2003e). Sea turtles may be crushed as the leveling device passes over and crushes a turtle which fails to move or is not pushed out of the way by the sediment wedge "wave" generated by and pushed ahead of the device. Sea turtles at Brunswick Harbor, Georgia, may have been crushed and killed in 2003 by bed-leveling which commenced after the hopper dredge finished its work in a particular area. Brunswick Harbor is also one of the sites where sea turtles captured by relocation trawlers sometimes show evidence of brumating (over-wintering) in the muddy channel bottom, which could explain why, if they were crushed by bed-leveler type dredges, they failed to react quickly enough to avoid the bed-leveler. However, the use of bed-levelers is probably preferable to the use of hopper dredges for cleanup operations, since turtles foraging, resting, or brumating on irregular bottoms are probably more likely to be entrained by suction dragheads than crushed by bed-levelers, because: 1) sea turtle deflector dragheads are less effective on uneven bottoms; 2) hopper dredges move considerably faster than bed-leveler "dredges;" and 3) bed-levelers do not use suction.

NMFS believes it is unlikely that turtles will be taken by potential bed-leveling activities during "high-spot cleanup" during the proposed action since sea turtles are not expected to be brumating during the proposed dredging, and will likely be more active due to warmer water temperatures. Additionally, the proposed modifications (i.e., integrated deflector configurations) to traditional bed-levelers are expected to further reduce the potential for impacts to sea turtles. However, if compelling STSSN observer reports and evidence indicate that a turtle was killed by a bed-leveler associated with the proposed action covered by this opinion, reinitiation of consultation will be required (see RPMs, Term and Condition No. 6).

5.3 Modified Relocation Trawling

Dickerson et al. (2007; 2008) concluded that the act of trawling (moving a net or other system through the water) reduces the incidence of lethal take of sea turtles by hopper dredges and suggested that there is no need to actually physically relocate the animal to avoid entrainment by the dredges. Furthermore, the effectiveness of trawling in reducing dredge takes was found to be related to the level of trawling effort. Therefore, the requirement to physically relocate the animals, which reduces time available for trawling, may actually reduce the effectiveness of this conservation method. Based on these analyses, relocation trawling for this project will not be implemented in the traditional manner. Unlike traditional relocation trawling where the turtle is handled and sampled for biological information, a modified shrimp-net-like structure or other device will be deployed to encourage animals off the bottom. This method of modified relocation trawling will prevent the need for turtles to be captured in the net (where they necessarily undergo the stress associated with net capture, net retrieval, and handling on deck), yet would achieve the objective of getting the turtle off the bottom and up into the water column and away from the draghead of a hopper dredge. Because the modified style of relocation trawling will not interrupt trawling operations by the need to stop to actively retrieve the gear, then handle, measure, tag, and relocate any captured turtles, sea turtle mortality could be reduced further. Based on our review of Dickerson et al. (2007; 2008), NMFS believes that modified relocation trawling (i.e., non-capture-type trawling) is likely effective at reducing the adverse effects of hopper dredging on sea turtles and it may even be more effective than conventional relocation trawling. While the analyses in Dickerson et al. (2007; 2008) suggest the benefits of modified turtle relocation trawling are compelling, NMFS notes the modified trawling methodology has not yet been fully developed nor the method's effectiveness fully validated. NMFS does believe that the method is effective; however, we do not have any quantitative basis to calculate a reduction in the estimated dredge takes for this project. Therefore to be conservative, we are going to assume that this technique will not reduce the number of sea turtles predicted to be killed by hopper dredges.

NMFS is presently coordinating with the COE's Engineer Research and Development Center (ERDC) to assist in refining gear design and trawling methodology. A modified system employing either a standard trawl net with an open codend; a "naked rig" using only tickler chains, rollers, or other ground gear but no net; a mat constructed of rubber or other similar material; or some similar apparatus will be dragged by a trawl vessel to disturb the sediment on the bottom, subsequently dispersing any turtles that may be on or in the bottom and in the dredge path. During January 2009, modified turtle relocation trawling was conducted at Brunswick Harbor Entrance Channel using a standard trawl net with an open codend. While traditional relocation trawling was initiated on January 2, 2009, in anticipation of the channel dredging that ultimately commenced on January 5, the trawler opened the codend and started non-capture trawling on January 6. As of January 26, approximately 700,000 cubic yards of material has been removed from the Brunswick Harbor Entrance Channel, and one take of a sea turtle by the dredge has been recorded (loggerhead, January 11).

Modified relocation trawling is intended to provoke a behavioral response to stimulate turtles from the bottom and up into the water column, where they are no longer likely to be taken by the draghead of a hopper dredge. This response may interrupt turtles' other bottom-oriented behaviors such as resting or foraging; however, the effects of these interruptions are expected to be insignificant, as similar resting and foraging habitats are available on either side of the subject channels. Sea turtles may also be affected if they were contacted by some portion of the trawl or "sweep" gear (e.g., trawl warps, doors, or tickler chains). Although the final design for the modified relocation trawling gear has not been selected for the dredging of Savannah, Brunswick, and Fernandina Harbor Entrance Channels, it is likely that it will not need to be as massive as the gear used for regular trawling, since the resistance of the trawl meshes and the weight of the catch will not have to be overcome. Lighter-weight trawl gear would further reduce the risk of injury, should contact occur. NMFS believes that sea turtles will be able to avoid most physical contact with the trawling gear and that the risk of injury from contact with gear is discountable.

5.4 Dredged Material Disposal

NMFS believes the proposed disposal activities are not likely to adversely affect sea turtles. Sea turtles are highly mobile and should be able to avoid a descending sediment plume discharged at the surface by a hopper dredge opening its hopper doors, or pumping its sediment load over the side. Even if temporarily enveloped in a sediment plume, NMFS believes the possibility of injury, or burial of sea turtles by material disposal, is discountable or its effects insignificant. The risk of injury to sea turtles from collisions with dredge-related vessels is also considered discountable, considering the species' mobility. An area directly south and west of the Fernandina ODMDS site contains hard-bottom that may be used by sea turtles for foraging and/or resting. However, disposal operations will occur within a 500-foot buffer inside each ODMDS boundary so that none of the disposed material will fall outside the boundary. Further, NMFS believes that foraging habitat for sea turtles is not likely a limiting factor in the action area, and thus the loss of potential sand bottom foraging habitat adjacent to, or on the surface of, the ODMDSs (compared to remaining foraging habitat) from burial by dredged material sediments will have insignificant effects on sea turtles.

6 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 human uses of the action area, such as boating and fishing, 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 posed by incidental capture by fishermen, vessel collisions, marine debris, chemical discharges, and man-made noises.

Beachfront development, lighting, and beach erosion control are all ongoing activities along the southeastern coast of the United States. These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Human activities and development along nesting beaches may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, more and more coastal counties 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 lawsuits 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.

NMFS presumes that any additional increases in recreational vessel activity in inshore and offshore waters of the Atlantic Ocean will likely increase the risk of turtles taken by injury or mortality in vessel collisions. Recreational hook-and-line fisheries have been known to lethally take sea turtles. 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.

7 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 affected ESA-listed sea turtles. In Section 5, we outlined how the proposed action can affect sea turtles, and the extent of those effects in terms of estimates of the numbers of each species expected to be killed. Now we turn to an assessment of each species' response to this impact, in terms of overall population effects from the estimated take, and whether those effects of the proposed action, 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 reduce appreciably the likelihood of both the survival and the recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). Thus, in making this determination for each species, we must first determine 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 Survival and Recovery of Loggerhead Sea Turtles in the Wild

The lethal take of 16 loggerhead sea turtles during this action would reduce the number of loggerhead sea turtles as compared to the number of loggerhead sea turtles that would have been present in the absence of the proposed action assuming all other variables remained the same. These lethal takes could also result in the loss of reproductive value as compared to the reproductive value in the absence of the proposed action, assuming some of these individuals are females, eliminating each individual's contribution to future generations. For example, an adult female loggerhead sea turtle can lay 3 or 4 clutches of eggs every 2 to 4 years, with 100 to 130 eggs per clutch. The annual loss of adult female sea turtles, on average, could preclude the production of thousands of eggs and hatchlings of which a small percentage (as low as one percent) are expected to survive to sexual maturity (Frazer 1983).

Changes in distribution are not expected from lethal takes by hopper dredging during this action. Because all the potential takes are expected to occur at random throughout the action area and sea turtles generally have large ranges in which they disperse, no reduction in the distribution of loggerhead sea turtles is expected from the take of these individuals.

Whether the reductions in numbers and reproduction of this species attributed to the action would appreciably reduce its likelihood of survival depends on the effect the changes in numbers and reproduction would have on 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 26 percent in the annual nest density of surveyed shoreline over a 20-year period (1989-2008) and a 41 percent decline since 1998 (letter to NMFS from the Director, Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, December 9, 2008; Meylan et al. 2006). Data collected in Florida for the 2008 loggerhead nesting season revealed an increase in numbers over 2007 levels but not a reverse in the long-term declining trend observed between 1998 and 2008. 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 (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 to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007).

These declining nesting beach trends also seem in contradiction to some in-water survey results. Epperly et al. (2007) reported a 13.2 percent per year increase 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. Bresette, 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 believe the proposed action will not have a measurable negative effect on either of these trends. Estimates of the total loggerhead population in the Atlantic are not currently available. However, TEWG (1998) estimated the total loggerhead population of benthic individuals in United States waters—a subset of the whole Western Atlantic population—at over 200,000. While this population estimate is dated, it provides some context for evaluating the size of the likely population of loggerheads in the Atlantic. Scaled against the likely size of the population, and the magnitude of the trends noted above, even if they accurately represent the status of the loggerhead population, we do not believe the 16 lethal takes projected to result from this project will have a measurable impact on the likelihood of the loggerhead's survival in the wild, even if all 16 turtles are reproductive females.

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, directly or indirectly, as a result of the potential reduction in numbers or reproduction projected for this action.

Although no change in distribution of loggerhead sea turtles was predicted to result from the action, we concluded lethal takes would result in an instantaneous reduction in absolute population numbers that may also reduce reproduction, but these reductions are not expected to appreciably reduce the likelihood of survival of loggerhead sea turtles in the wild. The following analysis considers the effects of the anticipated take on the likelihood of recovery in the wild. We consider the recovery objectives in the recovery plan prepared for loggerhead sea turtles that relate to population numbers or reproduction that may be affected by the predicted reductions in the numbers or reproduction of sea turtles resulting from the proposed action.

The Recovery Plan for the Northwest Atlantic population of loggerhead sea turtles (NMFS and USFWS 2008) lists the following relevant recovery criteria:

Number of Nests and Number of Nesting Females

- Northern Recovery Unit (a 2 percent annual rate of increase was used to develop the Demographic Criteria because this recovery unit is between 1,000 and 10,000 nests per year, currently declining, and moderately vulnerable to extinction from stochastic events)
    (1) There is statistical confidence (95 percent) that the annual rate of increase over a generation time of 50 years is 2 percent or greater resulting in a total annual number of nests of 14,000 or greater for this recovery unit (approximate distribution of nests is NC=14 percent [2,000], SC=66 percent [9,200], and GA=20 percent [2,800]).
    (2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).
- Peninsular Florida Recovery Unit (a 1 percent minimal detectable annual rate of increase was used to develop the demographic criteria because this recovery unit is greater than 10,000 nests per year and determined least vulnerable to extinction from stochastic events)
    (1) There is statistical confidence (95 percent) that the annual rate of increase over a generation time of 50 years is statistically detectable (1 percent) resulting in a total annual number of nests of 106,100 or greater for this recovery unit.
    (2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).
- Dry Tortugas Recovery Unit (a 3 percent annual rate of increase was used to develop the demographic criteria because this recovery unit is less than 1,000 nests per year and highly vulnerable to extinction from stochastic events)
    (1) There is statistical confidence (95 percent) that the annual rate of increase over a generation time of 50 years is 3 percent or greater resulting in a total annual number of nests of 1,100 or greater for this recovery unit.
    (2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).
- Northern Gulf of Mexico Recovery Unit (a 3 percent annual rate of increase was used to develop the demographic criteria because this recovery unit is less than 1,000 nests per year and highly vulnerable to extinction from stochastic events)
    (1) There is statistical confidence (95 percent) that the annual rate of increase over a generation time of 50 years is 3 percent or greater resulting in a total annual number of nests of 4,000 or greater for this recovery unit (approximate distribution of nests (2002-2007) is FL= 92 percent [3,700] and AL=8 percent [300]).

(2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

- Greater Caribbean Recovery Unit
  (1) The total annual number of nests at a minimum of three nesting assemblages, each averaging greater than 100 nests annually (e.g., Yucatán, Mexico; Cay Sal Bank, The Bahamas), has increased over a generation time of 50 years.
  (2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

Trends in Abundance on Foraging Grounds
A network of index in-water sites, both oceanic and neritic, distributed across the foraging range is established and monitoring is implemented to measure abundance. There is statistical confidence (95 percent) that a composite estimate of relative abundance from these sites is increasing for at least one generation.

Trends in Strandings Relative to In-water Abundance
Stranding trends are not increasing at a rate greater than the trends in in-water relative abundance for similar age classes for at least one generation.

The potential lethal take of 16 loggerheads during this action will result in reduction in numbers when takes occur and possibly by lost future reproduction, but, given the magnitude of these trends and likely large absolute population size, it is unlikely to have any detectable influence on the population objectives and trends noted above. Thus, the proposed action is not expected to result in an appreciable reduction in the likelihood of loggerhead sea turtle recovery in the wild.

7.2 Effects of the Action on the Likelihood of Survival and Recovery of Green Sea Turtles in the Wild

The lethal take of one green sea turtle by the action would reduce the number of green sea turtles as compared to the number that would have been present in the absence of the action assuming all other variables remained the same. The lethal take could also result in the loss of reproductive value as compared to the reproductive value in the absence of the proposed action, if the individual is female, eliminating her contribution to future generations. Greens nest frequently (at approximately two week intervals) during a nesting season and nest about every 2-4 years. During each nesting, they can produce an average of 110-115 eggs in each nest. The loss of an adult female could preclude the production of thousands of eggs and hatchlings, of which a small percentage are expected to survive to sexual maturity. Changes in distribution are not expected from lethal takes by hopper dredging during this action. Because the action area is small and sea turtles generally have large ranges in which they disperse, no reduction in the distribution of green sea turtles is expected from the take of one individual.

The 5-year status review for green sea turtles states that of the seven green sea turtle nesting concentrations in the Atlantic basin for which abundance trend information is available, all were determined to be either stable or increasing (NMFS and USFWS 2007a). That review also states that the annual nesting female population in the Atlantic basin ranges from 29,243-50,539 individuals. Additionally, the pattern of green sea turtle nesting shows biennial peaks in abundance, with a generally positive trend during the twenty years of regular monitoring since establishment of index beaches in Florida in 1989. An average of 5,099 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 of one green sea turtle expected from the proposed action would result in an instantaneous reduction in absolute population numbers, it is not likely this small reduction would appreciably reduce the likelihood of survival of the species. If the hatchling survival rate to maturity is greater than the mortality rate of the population, the loss of a breeding individual would be replaced through recruitment of new breeding individuals from successful reproduction of non-taken sea turtles. Considering that the species' nesting trends are either stable or increasing, we believe the loss of one green sea turtle associated with the proposed action is not expected to cause an appreciable reduction in the likelihood of survival of this species of sea turtle in the wild.

Although no change in distribution of green sea turtles was predicted to result from the action, we concluded lethal takes would result in an instantaneous reduction in absolute population numbers that may also reduce reproduction, but these reductions are not expected to appreciably reduce the likelihood of survival of this species in the wild. The following analysis considers the effects of the anticipated take on the likelihood of recovery in the wild. We consider the recovery objectives in the recovery plan prepared for green sea turtles that relate to population numbers or reproduction that may be affected by the predicted reductions in the numbers or reproduction of sea turtles resulting from the proposed action.

The Recovery Plan for the U.S. 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 2001-2006 has been documented as follows: 2001 – 581 nests, 2002 – 9,201 nests, 2003 – 2,622, 2004 – 3,577 nests, 2005 – 9,644 nests, and 2006 – 4,970 nests. This averages 5,099 nests annually over the past 6 years (NMFS and USFWS 2007a).
- A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.
    - Several actions are being taken to address this objective, however there are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds.

The potential lethal take of one green sea turtle during this action will result in a reduction in numbers when the take occurs and possibly in future reproduction, but, given the magnitude of these trends, is unlikely to have any detectable influence on the population objectives or trends noted above. Thus, the effects of the proposed action will not result in an appreciable reduction in the likelihood of green sea turtle recovery in the wild.

7.3 Effect of the Action on the Likelihood of Survival and Recovery of Kemp's Ridley Sea Turtles in the Wild

The lethal take of seven Kemp's ridley sea turtles by the action would reduce the number of Kemp's ridley sea turtles as compared to the number that would have been present in the absence of the action assuming all other variables remained the same. The lethal take could also result in the loss of reproductive value as compared to the reproductive value in the absence of the proposed action, if the individual is female, eliminating her contribution to future generations. Kemps nest about every two years. Each nest contains approximately 100 eggs, with an average of 2.5 nests/female/season. The loss of an adult female could preclude the production of thousands of eggs and hatchlings, of which a small percentage are expected to survive to sexual maturity. Changes in distribution are not expected from lethal takes by hopper dredging during this action. Because the action area is small and sea turtles generally have large ranges in which they disperse, no reduction in the distribution of Kemp's ridley sea turtles is expected from the take of seven individuals.

The total population of Kemp's ridleys is not known, but nesting has been increasing significantly in the past two decades (9 to 13 percent per year) with over 15,000 nests recorded in 2007 (Gladys Porter Zoo 2007). 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 of seven Kemp's ridley sea turtles expected from the proposed action would result in an instantaneous reduction in absolute population numbers, it is not likely these small reductions would appreciably reduce the likelihood of survival of the 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 the species' nesting trends are either stable or increasing, we believe the loss of seven Kemp's ridley 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 turtle in the wild.

Although no change in distribution of Kemp's ridley sea turtles was predicted to result from the action, we concluded lethal takes would result in an instantaneous reduction in absolute population numbers that may also reduce reproduction, but these reductions are not expected to appreciably reduce the likelihood of survival of this species in the wild. The following analysis considers the effects of the anticipated take on the likelihood of recovery in the wild. We consider the recovery objectives in the recovery plan prepared for Kemp's ridley sea turtles that relate to population numbers or reproduction that may be affected by the predicted reductions in the numbers or reproduction of sea turtles resulting from the proposed action.

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. 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).

The potential lethal take of seven Kemp's ridley sea turtles during this action will result in reduction in numbers when takes occur and possibly in future reproduction, but, given the magnitude of these trends, is unlikely to have any detectable influence on the population objective or trends noted above. Thus, the effects of the proposed action will not result in an appreciable reduction in the likelihood of Kemp's ridley sea turtle recovery in the wild.

Based on the above analysis, we believe that the anticipated lethal sea turtle takes associated with the proposed action are not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of loggerhead, green, or Kemp's ridley sea turtles in the wild.

8 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.

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 our final jeopardy analysis is for the global populations as listed in the ESA. Because the proposed action is not reasonably expected to reduce appreciably the likelihood of survival and recovery of any Atlantic populations of sea turtles, it is our opinion that the Savannah, Brunswick, and Fernandina Harbor Entrance Channel projects are also not likely to jeopardize the continued existence of loggerhead, green, or Kemp's ridley sea turtles.

9 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 in order to provide an incidental take statement for an endangered or threatened species of marine mammal, the taking must be authorized under section 101(a)(5) of the MMPA. Since no incidental take of listed marine mammals is expected or has been authorized under section 101(a)(5) of the MMPA, no statement on incidental take of endangered whales is provided, and no take is authorized. Nevertheless, the COE 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

Based on historical distribution data, hopper dredge observer reports, and observations of past strandings, loggerhead, green, and Kemp's ridley sea turtles may occur in the action area and may be taken by the hopper dredging operations of this project. NMFS believes that the proposed action can be expected to lethally take up to 24 sea turtles (16 loggerhead, 1 green, and 7 Kemp's ridley sea turtles) during the proposed project. However, because we expect observers will detect and record approximately 66 percent of total mortality, the ITS issued for this opinion is 16 documented turtle takes, consisting of 10 loggerhead, 1 green, and 5 Kemp's ridley sea turtles (based on the species composition observed in the 2000-2008 dredging projects).

9.2 Effect of the Take

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

9.3 Reasonable and Prudent Measures

NMFS has determined that the following RPMs are necessary and appropriate to minimize impacts of the incidental take of sea turtles during the proposed action. The RPMs that NMFS believes are necessary to minimize the impacts of the proposed hopper dredging have been discussed with the COE in the past and are standard operating procedures, and include the use of intake and overflow screening, use of sea turtle deflector dragheads, observer and reporting requirements, and modified turtle relocation trawling. The following RPMS and associated terms and conditions are established to implement these measures, and to document incidental takes. Only incidental takes that occur while these measures are in full implementation are authorized.

Experience has shown that injuries sustained by sea turtles entrained in the hopper dredge dragheads are usually fatal. Current regional opinions for hopper dredging require observer monitoring requirements, deflector dragheads, and conditions and guidelines for relocation trawling, which NMFS believes are necessary to minimize effects of these removals on listed sea turtle species that occur in the action area.

1. Take Reporting: Observer Requirements and Dredged Material Screening

NMFS-approved observers monitor dredged material inflow and overflow screening baskets on many projects; however, screening is only partially effective and observed, documented takes provide only partial estimates of total sea turtle mortality. NMFS believes that some listed species taken by hopper dredges go undetected because body parts are forced through the sampling screens by the water pressure and are buried in the dredged material, or animals are crushed or killed but not entrained by the suction and so the takes may go unnoticed. The only mortalities that are documented are those where body parts either float, are large enough to be caught in the screens, and/or can be identified as from sea turtle species. However, this opinion estimates that with 4-inch inflow screening in place, 100 percent observer coverage will probably detect and record approximately 66 percent of total mortality. Additionally, coordination with local sea turtle stranding networks can be a valuable adjunct monitoring method; not to directly monitor takes, but to help ensure that unanticipated impacts to sea turtles are not occurring.

2. Deflector Dragheads

V-shaped, sea turtle deflector dragheads prevent an unquantifiable yet significant number of sea turtles from being entrained and killed in hopper dredges each year. Without them, turtle takes during hopper dredging operations would unquestionably be higher. Draghead tests conducted in May-June 1993 by the COE's Waterways Experimental Station (WES), now known as the Engineering Research and Development Center (ERDC), in clear water conditions on the sea floor off Fort Pierce, Florida, with 300 mock turtles placed in rows, showed convincingly that the newly-developed WES deflector draghead "performed exceedingly well at deflecting the mock turtles." Thirty-seven of 39 mock turtles encountered were deflected, 2 turtles were not deflected, and none were damaged. Also, "the deflector draghead provided better production rates than the unmodified California draghead, and the deflector draghead was easier to operate and maneuver than the unmodified California flat-front draghead." The V-shape reduced forces encountered by the draghead, and resulted in smoother operation. V-shaped deflecting dragheads are now a widely accepted conservation tool, the dredging industry is familiar with them and their operation, and they are used by all COE Districts conducting hopper dredge operations where turtles may be present.

3. Modified Relocation Trawling

Relocation trawling has proved to be a useful conservation tool in most dredging projects where it has been implemented. The September 22, 1995, RBO to the COE's New Orleans and Galveston Districts on hopper dredging of channels in Texas and Louisiana included a conservation recommendation for relocation trawling which stated that "Relocation trawling in advance of an operating dredge in Texas and Louisiana channels should be considered if takes are documented early in a project that requires use of a hopper dredge during a period in which large number of sea turtles may occur." That RBO was amended by NMFS (Amendment No. 1, June 13, 2002) to change the conservation recommendation to a term and condition of the RBO. Overall, it is NMFS' opinion that the COE Districts choosing to implement relocation trawling have benefited from their decisions. For example, in the Galveston District, Freeport Harbor Project (July 13-September 24, 2002), assessment and relocation trawling resulted in one loggerhead capture. In Sabine Pass (Sabine-Neches Waterway), assessment and relocation trawling in July-August 2002 resulted in five loggerhead and three Kemp's ridley sea turtle captures. One turtle was killed by the dredge; this occurred while the relocation trawler was in port repairing its trawl net (P. Bargo, pers. comm. 2002). In the Jacksonville District, sea turtles have been relocated out of the path of hopper dredges operating in Tampa Bay and Charlotte Harbor or their entrance channels. During St. Petersburg Harbor and Entrance Channel dredging in the fall of 2000, a pre-dredging risk assessment trawl survey resulted in capture, tagging, and relocation of two adult loggerheads and one subadult green turtle. In February 2002 during the Jacksonville District's Canaveral Channel emergency hopper dredging project for the Navy, two trawlers working around the clock captured and relocated 69 loggerhead and green turtles in seven days, and no turtles were entrained by the hopper dredge. In the Wilmington District's Bogue Banks Project in North Carolina, two trawlers successfully relocated five turtles in 15 days between March 13 and 27, 2003; one turtle was taken by the dredge. In 2003, Aransas Pass relocation trawling associated with hopper dredging resulted in 71 turtles captured and released (with three recaptures) in three months of dredging and relocation trawling. Five turtles were killed by the dredge. No turtles were killed after relocation trawling was increased from 12 to 24 hours per day (T. Bargo, pers. comm. to E. Hawk, October 27, 2003). In 2006, trawling associated with the dredging of the Houston-Galveston Navigation Channels resulted in 7 loggerheads relocated in 60 days of trawling (COE Sea Turtle Data Warehouse; http://el.erdc.usace.army.mil/seaturtles/index.cfm). In Fiscal Year 2007, relocation trawling activities in COE channel projects in the Gulf of Mexico resulted in the capture and relocation of 67 green, 42 Kemp's ridley, and 68 loggerhead sea turtles; in the South Atlantic, 18 loggerhead and 17 Kemp's ridley sea turtles were relocated (Ibid).

This opinion authorizes the use of modified turtle relocation trawling, using a modified system employing either a standard trawl net with an open codend; a "naked rig" using only tickler chains, rollers, or other ground gear but no net; a mat constructed of rubber or other similar material; or some similar apparatus towed by a trawl vessel. The use of modified relocation trawling will be required during all proposed hopper dredging during June 1 through September 30, 2009. NMFS expects the effect of any modified turtle relocation trawling to be non-lethal and non-injurious. Any effect to sea turtles from modified turtle relocation trawling is expected to be minimal and temporary (e.g., disturbance while resting, interruption of foraging, etc.), and, overall, beneficial as it is expected to reduce endangered species/hopper dredge interactions (i.e., lethal take).

Summary

NMFS believes that observer and screening requirements, deflector dragheads, and other best management practices have proved convincingly over the last decade to be excellent reasonable and prudent measures for minimizing the number and impact of sea turtle takes, enabling NMFS to assess the quantity of turtles being taken, and allowing the COE to meet its essential dredging requirements to keep federal navigation channels open. Additionally, NMFS expects the modified turtle relocation trawling to be as or more effective than traditional relocation trawling at reducing sea turtle/hopper dredge interactions

There are increased costs associated with observers and relocation trawling (recent estimates are $3,500-$5,000/day for 24 hours of relocation trawling and $150-$200/day for a hopper dredge endangered species observer). Dredging delays sometimes occur, particularly when clay-like materials clog the inflow screening boxes, and dredging projects may take longer to complete. However, overall, NMFS believes that: 1) loss of production associated with the deflector draghead is insignificant, while saving significant numbers of sea turtles from almost-certain death by dismemberment in suction dragheads; 2) increased production costs, including costs of observers and relocation trawlers, pale in comparison to overall project costs; and 3) NMFS' experience over the past decade with the COE has shown that federal hopper dredging projects get completed in a timely fashion. Also, allowable overdredging by the COE reduces to some degree the need for frequent maintenance dredging, and the conservation measures required by the biological opinions in place result in significantly reduced dredge interactions with sea turtles, interactions which usually prove fatal.

9.4 Terms and Conditions

In order to be exempt from liability for take prohibited by section 9 of the ESA, the COE must comply with the following terms and conditions, which implement the RPMs described above. These terms and conditions are non-discretionary.

1. <u>Observers (RPM 1)</u>: The COE shall arrange for NMFS-approved protected species observers to be aboard the hopper dredges to monitor the hopper bin, screening, and dragheads for sea turtles and their remains. Observer coverage sufficient for 100 percent monitoring (i.e., two observers) of hopper dredging operations is required aboard the hopper dredges throughout the proposed project.

2. <u>Screening (RPM 1)</u>: 100 percent inflow screening of dredged material is required and 100 percent overflow screening is recommended. If conditions prevent 100 percent inflow screening, inflow screening may be reduced gradually, as further detailed in the following paragraph, but 100 percent overflow screening is then required.

   a. Screen Size: The hopper's inflow screens should have 4- by 4-inch screening. If the SAD, in consultation with observers and the draghead operator, determines that the draghead is clogging and reducing production substantially, the screens may be modified sequentially: mesh size may be increased to 6-inch by 6-inch, then 9-inch by 9-inch, then 12-inch by 12-inch openings. Clogging should be greatly reduced with these flexible options; however, further clogging may compel removal of the screening altogether, in which case effective 100 percent overflow screening is mandatory. The COE shall notify NMFS beforehand if inflow screening is going to be reduced or eliminated, and provide details of how effective overflow screening will be achieved.

   b. Need for Flexible, Graduated Screens: NMFS believes that this flexible, graduated-screen option is necessary, since the need to constantly clear the inflow screens will increase the time it takes to complete the project and therefore increase the exposure of sea turtles to the risk of impingement or entrainment. Additionally, there are increased risks to sea turtles in the water column when the inflow is halted to clear screens, since this results in clogged intake pipes, which may have to be lifted from the bottom to discharge the clay by applying suction.

3. Dredging Pumps: Standard operating procedure shall be that dredging pumps shall be disengaged by the operator when the dragheads are not firmly on the bottom, to prevent impingement or entrainment of sea turtles within the water column. This precaution is especially important during the cleanup phase of dredging operations when the draghead frequently comes off the bottom and can suck in turtles resting in the shallow depressions between the high spots the draghead is trimming off.

4. Sea Turtle Deflecting Draghead (RPM 2): A state-of-the-art rigid deflector draghead must be used on all hopper dredges at all times.

5. Dredge Take Reporting and Final Report: Observer reports of incidental take by hopper dredges must be faxed to NMFS' Southeast Regional Office (phone: 727/824-5312, fax: 727/824-5309, or electronic mail: **takereport.nmfsser@noaa.gov**) by onboard NMFS-approved protected species observers, the dredging company, or the COE within 24 hours of any sea turtle or other listed species take observed.

   A final report summarizing the results of the hopper dredging and any documented sea turtle or other listed species takes must be submitted to NMFS within 30 working days of completion of the dredging project. Reports shall contain information on project location (specific channel/area dredged), start-up and completion dates, cubic yards of material dredged, problems encountered, incidental takes and sightings of protected species, mitigative actions taken, screening type (inflow, overflow) utilized, daily water temperatures, name of dredge, names of endangered species observers, percent observer coverage, and any other information the SAD deems relevant.

6. Sea Turtle Strandings (RPM 1): The SAD Project Manager or designated representative shall notify the Sea Turtle Stranding and Salvage Network (STSSN) state representative (contact information available at: http://www.sefsc.noaa.gov/seaturtleSTSSN.jsp) of the start-up and completion of hopper dredging operations and bed-leveler dredging operations and ask to be notified of any sea turtle strandings in the project area that, in the estimation of STSSN personnel, bear signs of potential draghead impingement or entrainment, or interaction with a bed-leveling type dredge.

   Information on any such strandings shall be reported in writing within 30 days of project end to NMFS' Southeast Regional Office. If compelling STSSN observer reports and evidence indicate that a turtle was killed by a bed-leveler associated with the proposed actions covered by this opinion, the COE shall reinitiate the consultation.

7. Reporting - Strandings: The COE shall provide NMFS' Southeast Regional Office with a report detailing incidents, with photographs when available, of stranded sea turtles that bear indications of draghead impingement or entrainment.

8. Modified Relocation Trawling (RPM 3): Prior to modified turtle relocation trawling, the COE shall develop and submit to NMFS detailed specifications on the final selected modified turtle relocation trawling gear sufficiently ahead of planned dredging activities for NMFS to review and comment on the plans. NMFS fisheries gear specialists may be

able to provide technical assistance in developing specifications. The use of modified relocation trawling will be required during all proposed hopper dredging during June 1 through September 30, 2009.

9. Modified Relocation Trawling Report (RPM 3): The COE shall provide NMFS' Southeast Regional Office with an end-of-project report within 30 days of completion of any modified relocation trawling. This report may be incorporated into the final report summarizing the results of the hopper dredging project.

10. Additional Relocation Trawler Requirements (RPM 3): Any relocation trawling conducted or contracted by the COE to temporarily reduce or assess the abundance of these listed species during a hopper dredging project in order to reduce the possibility of lethal hopper dredge interactions is subject to the following conditions:

a. Handling: Sea turtles recovered by observers on modified relocation trawlers (e.g., turtles incidentally captured in modified trawl gear, injured turtles recovered on the surface, etc.) shall be handled in a manner designed to ensure their safety and viability, and shall be released over the side of the vessel, away from the propeller, and only after ensuring that the vessel's propeller is in the neutral, or disengaged, position (i.e., not rotating). Resuscitation guidelines are attached (Appendix I).

b. Captured Sea Turtle Holding Conditions: Sea turtles may be held briefly for the collection of important scientific measurements, prior to their release. Captured sea turtles shall be kept moist, and shaded whenever possible, until they are released, according to the requirements of Term and Condition No. 10-e, below.

c. Scientific Measurements: When safely possible, all turtles shall be measured (standard carapace measurements including body depth), tagged, weighed, and a tissue sample taken prior to release. Any external tags shall be noted and data recorded into the observers log. Only NMFS-approved protected species observers or observer candidates in training under the direct supervision of a NMFS-approved protected species observer shall conduct the tagging/measuring/weighing/tissues sampling operations.

NMFS-approved protected species observers may conduct more invasive scientific procedures (e.g., blood letting, laparoscopies, external tumor removals, anal and gastric lavages, mounting satellite or radio transmitters, etc.) and partake in or assist in "piggy back" research projects but only if the observer holds a valid federal sea turtle research permit (and any required state permits) authorizing the activities, either as the permit holder, or as designated agent of the permit holder, and has first notified NMFS' Southeast Regional Office, Protected Resources Division.

d. Injuries: Injured sea turtles shall be immediately transported to the nearest sea turtle rehabilitation facility. Minor skin abrasions resulting from trawl capture are considered non-injurious. The COE shall ensure that logistical arrangements and support to accomplish this are pre-planned and ready, and is responsible for ensuring that dredge vessel personnel comply with this requirement. The COE shall bear the financial cost of sea turtle transport, treatment, and rehabilitation.

e. Flipper Tagging: All sea turtles captured by relocation trawling shall be flipper-tagged prior to release with external tags which shall be obtained prior to the project from the University of Florida's Archie Carr Center for Sea Turtle Research. This opinion serves as the permitting authority for any NMFS-approved protected species observer aboard these relocation trawlers to flipper-tag with external tags (e.g., Inconel tags) captured sea turtles. Columbus crabs or other organisms living on external sea turtle surfaces may also be sampled and removed under this authority.

f. PIT-Tag Scanning: This opinion serves as the permitting authority for any NMFS-approved protected species observer aboard a relocation trawler to PIT-tag captured sea turtles. PIT tagging of sea turtles is not required to be done if the NMFS-approved protected species observer does not have prior training or experience in said activity; however, if the observer has received prior training in PIT tagging procedures, then the observer shall PIT tag the animal prior to release (in addition to the standard external tagging):

Sea turtle PIT tagging must then be performed in accordance with the protocol detailed at NMFS' Southeast Fisheries Science Center's Web page: http://www.sefsc.noaa.gov/seaturtlefisheriesobservers.jsp. (See Appendix C on SEFSC's "Fisheries Observers" Web page);

PIT tags used must be sterile, individually-wrapped tags to prevent disease transmission. PIT tags should be 125-kHz, glass-encapsulated tags–the smallest ones made. Note: If scanning reveals a PIT tag and it was not difficult to find, then do not insert another PIT tag; simply record the tag number and location, and frequency, if known. If for some reason the tag is difficult to detect (e.g., tag is embedded deep in muscle, or is a 400-kHz tag), then insert one in the other shoulder.

g. Other Sampling Procedures: All other tagging and external or internal sampling procedures (e.g., blood letting, laparoscopies, external tumor removals, anal and gastric lavages, mounting satellite or radio transmitters, etc.) performed on live sea turtles are not permitted under this opinion unless the observer holds a valid sea turtle research permit authorizing the activity, either as the permit holder or a designated agent of the permit holder.

h. PIT-Tag Scanning and Data Submission Requirements: All sea turtles captured by relocation trawling or dredges shall be thoroughly scanned for the presence of PIT tags prior to release using a multi-frequency scanner powerful enough to read multiple frequencies (including 125-, 128-, 134-, and 400-kHz tags) and read tags deeply embedded in muscle tissue (e.g., manufactured by Trovan, Biomark, or Avid). Turtles whose scans show they have been previously PIT tagged shall nevertheless be externally flipper tagged. Sea turtle data collected (PIT tag scan data and external tagging data) shall be submitted to NOAA, National Marine Fisheries Service, Southeast Fisheries

i. Handling Fibropapillomatose Turtles: NMFS-approved protected species observers are not required to handle viral fibropapilloma tumors if they believe there is a health hazard to themselves and choose not to. When handling sea turtles infected with fibropapilloma tumors, observers must maintain a separate set of sampling equipment for handling animals displaying fibropapilloma tumors or lesions.

11. Requirement and Authority to Conduct Tissue Sampling for Genetic and Contaminants Analyses: This opinion serves as the permitting authority for any NMFS-approved protected species observer aboard a relocation trawler or hopper dredge to tissue-sample live- or dead-captured sea turtles without the need for an ESA section 10 permit.

All live or dead sea turtles captured by relocation trawling and hopper dredging (for both COE-conducted and COE-permitted activities) shall be tissue-sampled prior to release. Sampling shall continue uninterrupted until such time as NMFS determines and notifies the COE in writing.

Sea turtle tissue samples shall be taken in accordance with NMFS' SEFSC procedures for sea turtle genetic analyses (Appendix II), and, as specified, for contaminants (e.g., heavy metals) analyses. Protocols for tissue sampling to be utilized in contaminants analyses are currently being developed by Dr. Dena Dickerson, ERDC. The COE shall ensure that tissue samples taken during the dredging project are collected and stored properly and mailed every three months until completion of the dredging project to: NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149.

12. Training - Personnel on Hopper Dredges: The COE must ensure that all contracted personnel involved in operating hopper dredges (whether privately-funded or federally-funded projects) receive thorough training on measures of dredge operation that will minimize takes of sea turtles. It shall be the goal of the hopper dredging operation to establish operating procedures that are consistent with those that have been used successfully during hopper dredging in other regions of the coastal United States, and which have proven effective in reducing turtle/dredge interactions. Therefore, COE Engineering Research and Development Center experts or other persons with expertise in this matter shall be involved both in dredge operation training, and installation, adjustment, and monitoring of the rigid deflector draghead assembly.

13. Dredge Lighting: All lighting aboard hopper dredges and hopper dredge pumpout barges operating within 3 nm of sea turtle nesting beaches shall be limited to the minimal

14. Best Management Practices: The COE will require or conduct activities in compliance with NMFS' March 23, 2006, *Sea Turtle and Smalltooth Sawfish Construction Conditions* (Appendix III).

10 CONSERVATION RECOMMENDATIONS

Pursuant to section 7(a)(1) of the ESA, the following conservation recommendations are made to assist the SAD in contributing to the conservation of sea turtles by further reducing or eliminating adverse impacts that result from hopper dredging.

1. Draghead Modifications and Bed-Leveling Studies: The COE should supplement other efforts to develop modifications to existing dredges to reduce or eliminate take of sea turtles, and develop methods to minimize sea turtle take during "cleanup" operations when the draghead maintains only intermittent contact with the bottom. Some method to level the "peaks and valleys" created by dredging would reduce the amount of time dragheads are off the bottom. NMFS is ready to assist the COE in conducting studies to evaluate bed-leveling devices and their potential for interaction with sea turtles, and develop modifications if needed.

2. Draghead Evaluation Studies and Protocol: Additional research, development, and improved performance is needed before the V-shaped rigid deflector draghead can replace seasonal restrictions as a method of reducing sea turtle captures during hopper dredging activities. Development of a more effective deflector draghead or other entrainment-deterring device (or combination of devices, including use of acoustic deterrents) could potentially reduce the need for sea turtle relocation or result in expansion of the winter dredging window. NMFS should be consulted regarding the development of a protocol for draghead evaluation tests. NMFS recommends that COE coordinate with ERDC, the Association of Dredge Contractors of America, and dredge operators (Manson, Bean-Stuyvesant, Great Lakes, Natco, etc.) regarding additional reasonable measures they may take to further reduce the likelihood of sea turtle takes.

3. Continuous Improvements in Monitoring and Detecting Takes: The COE should seek continuous improvements in detecting takes and should determine, through research and development, a better method for monitoring and estimating sea turtle takes by hopper dredge. Observation of overflow and inflow screening is only partially effective and provides only partial estimates of total sea turtle mortality.

4. Overflow Screening: The COE should encourage dredging companies to develop or modify existing overflow screening methods on their company's dredge vessels for

5. Preferential Consideration for Horizontal Overflow Screening: The COE should give preferential consideration to hopper dredges with horizontal overflow screening when awarding hopper dredging contracts for areas where new materials, large amounts of debris, or clay may be encountered, or have historically been encountered. Excessive inflow screen clogging may in some instances necessitate removal of inflow screening, at which point effective overflow screening becomes more important.

6. Section 10 Research Permits, Relocation Trawling, Piggy-Back Research, and 50 CFR Part 223 Authority to Conduct Research on Salvaged, Dead Specimens: NMFS recommends that COE apply to NMFS for an ESA section 10 research permit to conduct endangered species research on species incidentally captured during traditional relocation trawling. For example, satellite tagging of captured turtles could enable the COE to gain important knowledge on sea turtle seasonal distribution and presence in navigation channels and also, as mandated by section 7(a)(1) of the ESA, to utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of listed species. SERO shall assist the COE with the permit application process.

   NMFS also encourages the COE to cooperate with NMFS' scientists, other federal agencies' scientists, and university scientists holding appropriate research permits to make fuller use of turtles taken or captured by hopper dredges and relocation trawlers pursuant to the authority conferred by this opinion. NMFS encourages "piggy-back" research projects by duly-permitted individuals or their authorized designees. Section 10-permitted piggy-back projects could include non-lethal research of many types, including blood letting, laparoscopies, anal and gastric lavages, mounting satellite or radio transmitters, etc. Research requiring tissue sampling, however, may be done under the authority of this opinion.

   Important research can be conducted without a section 10 permit on salvaged dead specimens. Under current federal regulations (see 50 CFR 223.206 (b): Exception for injured, dead, or stranded [threatened sea turtle] specimens), "Agents…of a Federal land or water management agency may…salvage a dead specimen which may be useful for scientific study." Similar regulations at 50 CFR 222.310 provide "salvaging" authority for endangered sea turtles.

7. Draghead Improvements - Water Ports: NMFS recommends that the COE require or at least recommend to dredge operators that all dragheads on hopper dredges contracted by the COE for dredging projects be eventually outfitted with water ports located in the top of the dragheads to help prevent the dragheads from becoming plugged with sediments. When the dragheads become plugged with sediments, the dragheads are often raised off the bottom by the dredge operator with the suction pumps on in order to take in enough water to help clear clogs in the dragarm pipeline, which increases the likelihood that sea

turtles in the vicinity of the draghead will be taken by the dredge. Water ports located in the top of the dragheads would relieve the necessity of raising the draghead off the bottom to perform such an action, and reduce the chance of incidental take of sea turtles.

NMFS supports and recommends the implementation of proposals by ERDC and COE personnel for various draghead modifications to address scenarios where turtles may be entrained during hopper dredging (Dickerson and Clausner 2003). These include: 1) An adjustable visor; 2) water jets for flaps to prevent plugging and thus reduce the requirement to lift the draghead off the bottom; and 3) a valve arrangement (which mimics the function of a "Hoffer" valve used on cutterhead type dredges to allow additional water to be brought in when the suction line is plugging) that will provide a very large amount of water into the suction pipe thereby significantly reducing flow through the visor when the draghead is lifted off the bottom, reducing the potential to take a turtle.

8. Economic Incentives for No Turtle Takes: The COE should consider devising and implementing some method of significant economic incentives to hopper dredge operators such as financial reimbursement based on their satisfactory completion of dredging operations, or X number of cubic yards of material moved, or hours of dredging performed, without taking turtles. This may encourage dredging companies to research and develop "turtle friendly" dredging methods; more effective, deflector dragheads; pre-deflectors; top-located water ports on dragarms; etc.

9. Sodium Vapor Lights on Offshore Equipment: On offshore equipment (i.e., hopper dredges, pumpout barges) shielded low-pressure sodium vapor lights are highly recommended for lights that cannot be eliminated.

11 REINITIATION OF CONSULTATION

This concludes formal consultation on the proposed seasonal maintenance dredging of the Savannah, Brunswick, and Fernandina Harbor Entrance Channels. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) The amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action.

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APPENDIX I

SEA TURTLE HANDLING AND RESUSCITATION GUIDELINES

Any sea turtles taken incidentally during the course of fishing or scientific research activities must be handled with due care to prevent injury to live specimens, observed for activity, and returned to the water according to the following procedures:

A) Sea turtles that are actively moving or determined to be dead (as described in paragraph (B)(4) below) must be released over the stern of the boat. In addition, they must be released only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels.

B) Resuscitation must be attempted on sea turtles that are comatose or inactive by:

1) Placing the turtle on its bottom shell (plastron) so that the turtle is right side up and elevating its hindquarters at least 6 inches (15.2 cm) for a period of 4 to 24 hours. The amount of elevation depends on the size of the turtle; greater elevations are needed for larger turtles. Periodically, rock the turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about 3 inches (7.6 cm) then alternate to the other side. Gently touch the eye and pinch the tail (reflex test) periodically to see if there is a response.

2) Sea turtles being resuscitated must be shaded and kept damp or moist but under no circumstance be placed into a container holding water. A water-soaked towel placed over the head, carapace, and flippers is the most effective method in keeping a turtle moist.

3) Sea turtles that revive and become active must be released over the stern of the boat only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels. Sea turtles that fail to respond to the reflex test or fail to move within 4 hours (up to 24, if possible) must be returned to the water in the same manner as that for actively moving turtles.

4) A turtle is determined to be dead if the muscles are stiff (rigor mortis) and/or the flesh has begun to rot; otherwise, the turtle is determined to be comatose or inactive and resuscitation attempts are necessary.

Any sea turtle so taken must not be consumed, sold, landed, offloaded, transshipped, or kept below deck.

These requirements are excerpted from 50 CFR 223.206(d)(1). Failure to follow these procedures is therefore a punishable offense under the Endangered Species Act.

APPENDIX II

PROTOCOL FOR COLLECTING TISSUE FROM SEA TURTLES FOR GENETIC ANALYSIS

Method for Dead Turtles

<<<IT IS CRITICAL TO USE A NEW SCALPEL BLADE AND GLOVES FOR EACH TURTLE TO AVOID CROSS-CONTAMINATION OF SAMPLES>>>

1) Put on a new pair of latex gloves.
2) Use a new disposable scalpel to cut out an approx. 1 cm (½ in) cube (bigger is NOT better) piece of muscle. Easy access to muscle tissue is in the neck region or on the ventral side where the front flippers "insert" near the plastron. It does not matter what stage of decomposition the carcass is in.
3) Place the muscle sample on a hard uncontaminated surface (plastron will do) and make slices through the sample so the buffer solution will penetrate the tissue.
4) Put the sample into the plastic vial containing saturated NaCl with 20 percent DMSO.*
5) Use the pencil to write the stranding ID number (observer initials, year, month, day, turtle number by day), species, state and carapace length on the waterproof paper label and place it in the vial with the sample. EXAMPLE: For a 35.8 cm curved carapace length green turtle documented by Jane M. Doe on July 15, 2001 in Georgia, the label should read "JMD20010715-01, C. mydas, Georgia, CCL=35.8 cm". If this had been the third turtle Jane Doe responded to on July 15, 2001, it would be JMD20010715-03.
6) Label the outside of the vial with the same information (stranding ID number, species, state and carapace length) using the permanent marker.
7) Place clear scotch tape over the writing on the vial to protect it from being smeared or erased.
8) Wrap parafilm around the cap of the vial by stretching it as you wrap.
9) Place vial within whirl-pak and close.
10) Dispose of the scalpel.
11) Note on the stranding form that a part was salvaged, indicating that a genetic sample was taken and specify the location on the turtle where the sample was obtained.
12) Submit the vial with the stranding report to your state coordinator. State coordinators will forward the reports and vials to NMFS for processing and archiving.

Method for Live Turtles

<<< IT IS CRITICAL TO USE A NEW BIOPSY PUNCH AND GLOVES FOR EACH TURTLE TO AVOID CROSS-CONTAMINATION OF SAMPLES >>>

1) Turn the turtle over on its back.
2) Put on a new pair of latex gloves.
3) Swab the entire cap of the sample vial with alcohol.
4) Wipe the ventral and dorsal surfaces of the rear flipper 5-10 cm from the posterior edge with the Betadine/iodine swab.
5) Place the vial under the flipper edge to use the cleaned cap as a hard surface for the punch.
6) Press a new biopsy punch firmly into the flesh as close to the posterior edge as possible and rotate one complete turn. Cut all the way through the flipper to the cap of the vial.
7) Wipe the punched area with Betadine/iodine swab; rarely you may need to apply pressure to stop bleeding.
8) Use a wooden skewer to transfer the sample from the biopsy punch into the plastic vial containing saturated NaCl with 20 percent DMSO.*

9) Use the pencil to write the stranding ID number (observer initials, year, month, day, turtle number by day), species, state and carapace length on the waterproof paper label and place it in the vial with the sample. EXAMPLE: For a 35.8 cm curved carapace length green turtle documented by Jane M. Doe on July 15, 2001 in Georgia, the label should read "JMD20010715-01, C. mydas, Georgia, CCL=35.8 cm". If this had been the third turtle Jane Doe responded to on July 15, 2001, it would be JMD20010715-03.
10) Label the outside of the vial with the same information (stranding ID number, species, state and carapace length) using the permanent marker.
11) Place clear scotch tape over the writing on the vial to protect it from being smeared or erased.
12) Wrap parafilm around the cap of the vial by stretching it as you wrap.
13) Place vial within whirl-pak and close.
14) Dispose of the biopsy punch.
15) Note on the stranding form that a part was salvaged, indicating that a genetic sample was taken and specify the location on the turtle where the sample was obtained.
16) Submit the vial with the stranding report to your state coordinator. State coordinators will forward the reports and vials to NMFS for processing and archiving.

***The 20 percent DMSO buffer in the plastic vials is nontoxic and nonflammable. Handling the buffer without gloves may result in exposure to DMSO. This substance soaks into skin very rapidly and is commonly used to alleviate muscle aches. DMSO will produce a garlic/oyster taste in the mouth along with breath odor. The protocol requires that you WEAR gloves each time you collect a sample and handle the buffer vials.**

The vials (both before and after samples are taken) should be stored at room temperature or cooler. If you don't mind the vials in the refrigerator, this will prolong the life of the sample. DO NOT store the vials where they will experience extreme heat (like in your car!) as this could cause the buffer to break down and not preserve the sample properly.

Questions:
Sea Turtle Program
NOAA/NMFS/SEFSC
75 Virginia Beach Drive
Miami, FL 33149
305-361-4207

THANK YOU FOR COLLECTING SAMPLES FOR SEA TURTLE GENETIC RESEARCH!!

Genetic Sample Kit Materials

- latex gloves
- alcohol swabs
- Betadine/iodine swabs
- 4-6 mm biopsy punch – sterile, disposable (Moore Medical Supply 1-800-678-8678, part #0052442)
- wooden skewer
- single-use scalpel blades (Fisher Scientific 1-800-766-7000, cat. # 08-927-5A)
- plastic screw-cap vial containing saturated NaCl with 20 percent DMSO, wrapped in parafilm
- waterproof paper label, ¼" x 4"
- pencil to write on waterproof paper label
- permanent marker to label the plastic vials
- scotch tape to protect writing on the vials

- piece of parafilm to wrap the cap of the vial
- whirl-pak to return/store sample vial

APPENDIX III

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006

APPENDIX IV

ANTICIPATED ANNUAL INCIDENTAL TAKE OF LOGGERHEAD, LEATHERBACK, KEMP'S RIDLEY, GREEN, AND HAWKSBILL SEA TURTLES AS OUTLINED IN THE MOST RECENT OPINIONS ON NMFS-AUTHORIZED FEDERAL FISHERIES

Fishery	Sea Turtle Species				
	Loggerhead	Leatherback	Kemp's Ridley	Green	Hawksbill
Atlantic Bluefish	(6) No more than 3 lethal takes	None	(6) Lethal or non-lethal takes	None	None
Coastal Migratory Pelagics	(11) Lethal takes	(2) Lethal takes for leatherbacks, hawksbill, and Kemp's ridley [both lethal takes]	(14) Lethal takes	(2) Lethal takes for Leatherbacks, hawksbill, and Kemp's ridley [both lethal takes]	
Dolphin-Wahoo	(12) No more than 2 lethal takes	(12) No more than 1 lethal take	(3) All species in combination; no more than 1 lethal take		
South Atlantic Snapper-Grouper	(68) No more than 23 lethal takes	(9) No more than 5 lethal takes	(7) No more than 3 lethal takes	(13) No more than 5 lethal takes	(2) No more than 1 lethal takes
Southeastern U.S. Shrimp	(163,160) No more than 3,948 lethal takes	(3,090) No more than 80 lethal takes	(155,503) No more than 4,208 lethal takes	(18,757) No more than 514 lethal takes	(640) All lethal
Atlantic HMS Pelagic Longline	(635) No more than 113 lethal takes	(588) No more than 28 lethal takes	(35) No more than 6 lethal takes for these species in combination		
Atlantic HMS Shark Fisheries	(679) No more than 346 lethal takes	(74) No more than 47 lethal takes	(2) No more than 1 lethal take	(2) No more than 1 lethal take	(2) No more than 1 lethal take