UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701-5505
727.824.5312, FAX 824.5309
http://sero.nmfs.noaa.gov

APR 24 2012

F/SER31:JR

Mr. Geoffrey Wikel
Bureau of Ocean Energy Management
Department of the Interior
381 Elden Street Mailstop 4042
Herndon, VA 20170

Re: Town of Longboat Key Outer Continental Shelf Resources Lease

Dear Mr. Wikel:

Enclosed is the National Marine Fisheries Service's (NMFS) biological opinion issued in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, on the Bureau of Ocean Energy Management's (BOEM) proposed action to issue an offshore sand lease to the Town of Longboat Key (Town). The Town proposes to renourish the beaches of Longboat Key with sand obtained from federal and state waters off Manatee and Sarasota Counties, Florida.

This biological opinion is the product of a reinitiated biological opinion (F/SER/2011/01074) and supersedes the findings of that prior opinion. The biological opinion analyzes the project's effects on five species of sea turtles and smalltooth sawfish. This opinion is based on project-specific information provided by BOEM, the applicant, and the applicant's consultants, as well as our review of published literature. It is our opinion that the action, as proposed, may adversely affect, but is not likely to jeopardize, sea turtles and smalltooth sawfish.

We look forward to further cooperation with you on other BOEM projects to ensure the conservation and recovery of our threatened and endangered marine species. If you have any questions regarding this consultation, please contact Jason Rueter, fishery biologist, at (727) 824-5350, or by e-mail at Jason.Rueter@noaa.gov.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure
File: 1514-22.F.4
Ref: F/SER/2012/00110

Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency:	Bureau of Ocean Energy Management (BOEM)
Activity:	Authorization for Dredging of Gulf of Mexico Sand Mining ("Borrow") Areas Using Hopper Dredges for the Town of Longboat Key, Beach Renourishment Project (Consultation Number F/SER/2012/00110) – Reinitiation of Consultation F/SER/2011/01074.
Consulting Agency:	National Oceanic and Atmospheric Administration, National Marine Fisheries Service, 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:	APR 24 2012

Contents

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. When the action of a federal agency may affect a protected species, that agency is required to consult with either the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the protected species that may be affected.

This document represents NMFS' biological opinion (opinion) based on our review of the proposed authorization by BOEM for dredging of Gulf of Mexico sand mining ("borrow") areas using hopper dredges for the Town's beach renourishment project and its effects on green sea turtles *(Chelonia mydas*), leatherback sea turtles (*Dermochelys coriacea*), hawksbill sea turtles *(Eretmochelys imbricata*), loggerhead sea turtles (*Caretta caretta*), Kemp's ridley sea turtles *(Lepidochelys kempii*), and smalltooth sawfish (*Pristis pectinata*).

Consultations are required when action agencies determine that a proposed action "may affect" listed species or designated critical habitat. Consultations on most listed marine species are conducted between the action agency and NMFS. Consultations are concluded after we determine that an action is not likely to adversely affect listed species or critical habitat, or after issuance of an 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 also states the amount or extent of incidental taking that may occur. Non-discretionary measures ("reasonable and prudent measures" - RPMs) to reduce the likelihood of interactions are developed, and conservation recommendations are made. Notably, there are no reasonable and prudent measures associated with critical habitat, only reasonable and prudent alternatives that avoid destruction or adverse modification.

This opinion is based on information provided by BOEM; the Town of Longboat Key ("the Town"); Coastal Planning and Engineering, Inc. (CP&E); previous NMFS opinions on hopper dredging including the November 19, 2003, regional biological opinion on hopper dredging in the Gulf of Mexico by the U.S. Army Corps of Engineers' (COE) combined Jacksonville, Mobile, New Orleans, and Galveston Districts, as amended; and dredging and sea turtle relocation trawling reports submitted by the COE and/or maintained on their Sea Turtle Data Warehouse Web site (http://el.erdc.usace.army.mil/seaturtles/index.cfm).

1.0 Consultation History

On March 16, 2011, a request was received from BOEM to initiate formal consultation under Section 7 of the ESA for the Town's proposed beach renourishment project in Longboat Key, Florida. Sand is proposed to be mined from borrow areas located in both state and federal waters to renourish Longboat Key. A biological assessment (BA) prepared by CP&E was included with the request. The BA was adopted by BOEM.

On May 19, 2011, a conference call with CP&E, BOEM, the U.S. Army Corps of Engineers' (COE) Jacksonville District, and NMFS' Habitat Conservation Division and Protected Resources Division was conducted for the Town to provide answers to outstanding questions on the project. Formal consultation was initiated.

NMFS issued its biological opinion to BOEM (F/SER/2011/01074) for the BOEM-authorized project on November 28, 2011.

On December 1, 2011, BOEM notified NMFS that there were concerns with the biological opinion's proposed action statement.

On December 5, 2011, a conference call was held with BOEM where NMFS was informed that the Town, unbeknownst to NMFS, had made significant modifications to the quantity, timing, and location of proposed sand extractions, thus significantly changing the scope and effects of the Town's proposed action. NMFS advised that reinitiation of formal consultation would be necessary.

On December 30, 2011, NMFS received a detailed list of the revised proposed action and the changes needed to be incorporated into a new (the present) biological opinion. Formal consultation was initiated on this date. The present opinion supersedes F/SER/2011/01074.

2.0 Description of the Action

Proposed Actions Occurring in Federal Waters
BOEM is proposing to issue a lease for the use of sand resources in the borrow area F2 (BAF2) of the Outer Continental Shelf (OCS) (i.e., federal waters) off the Town of Longboat Key ("the Town"), Florida. A map of the project area is provided in Figure 1.1. The Town is seeking a 10-year dredging permit for continued multiple nourishments of Longboat Key's shoreline from R44 in Manatee County to R29 in Sarasota County. An interim nourishment project is proposed for fiscal year 2011 and 2012 utilizing sand resources in OCS BAF2, which is located 12 miles offshore of Anna Maria Island in Manatee County, Florida. The interim project will take place between R12 and R17, R44 and R46a, and R47.5 and R50.5. The Town will then renourish the entire length of beach in FY 2013 and 2014, or later, using the remaining resources of BAF2 not located within the Port Dolphin Pipeline Corridor (http://www.portdolphin.com/). A medium-sized hopper dredge will excavate and transport sand from the borrow area to the seaward end of the submerged pipelines for pumping to the beach fill areas. Approximately 10,000 cubic yards (cy) of sand are expected to be moved each day from the borrow area, with a maximum of 466,500 cy from BAF2 being moved over the course of dredging. During the 10 years of potential dredging activities, operations within BAF2 will only occur for a total of 47 days over that 10-year time frame. At this time, however, the dredging plan only calls for the removal of 339,500 cy from BAF2 (34 days of dredging). The Town has agreed to comply with NMFS' *Sea Turtle and Smalltooth Sawfish Construction Conditions* and the reasonable and prudent measures, and implementing terms and conditions, of NMFS' 2003 Gulf of Mexico regional biological opinion[1] (GRBO) to the COE, as amended through Revision 2 dated January 9, 2007. The latter states (Term and Condition No. 1) that hopper dredging activities in Gulf of Mexico waters shall be conducted, whenever possible, between December 1 and March 31.

---

[1] NMFS regional biological opinion dated November 19, 2003, "Dredging of Gulf of Mexico Navigation Channels and Sand Mining ("Borrow") Areas Using Hopper Dredges by COE Galveston, New Orleans, Mobile, and Jacksonville Districts," (Consultation Number F/SER/2000/01287).

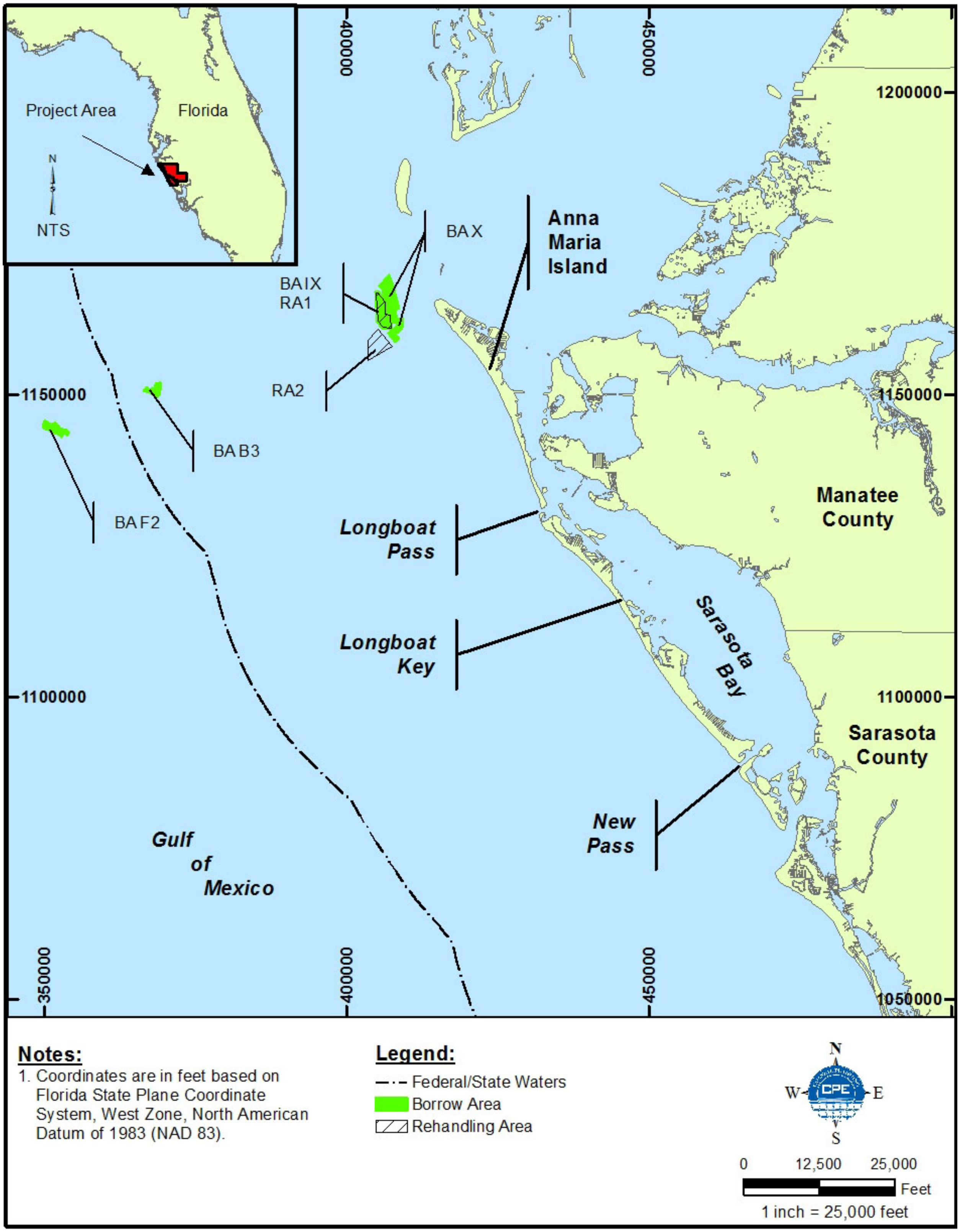

Figure 1.1. Map of project area.

Activities currently occurring and planned in conjunction with this project, as well as an emergency renourishment project completed in June 2011, and future sand extractions and renourishment activities conducted within *state* waters as part of the Longboat Key project, are within the scope of a previous NMFS Gulf of Mexico regional hopper dredging biological opinion issued to the COE (the GRBO). The GRBO governs (and is limited to) maintenance dredging, sand mining, and beach nourishment activities occurring in state waters, under the regulatory authority of the COE under Section 10 of the Rivers and Harbors Act and/or Section 404 of the Clean Water Act. Authorization to permit activities in federal waters, such as the proposed offshore sand mining, resides solely with BOEM (Geoffrey Wikel, BOEM, October 19, 2011, e-mail to Jill Lewandowski, BOEM), under the Outer Continental Shelf Lands Act . Since the Longboat Key project will use sand taken from borrow areas located in state and federal waters, those sand extractions from state waters as well as the associated renourishment activities, are considered to be interrelated and interdependent to the BOEM-proposed action, pursuant to the definition of effects of agency actions (50 CFR § 402.02), and must be considered in the present analysis. Therefore, the present opinion to BOEM considers *all* potential effects of the Longboat Key project, including protected species relocation trawling and all sand extractions (and beach placement of sand) by hopper dredging in state and/or federal waters from the shoreline of Longboat Key seaward to and including areas under the jurisdiction of each agency.

The GRBO has already analyzed and authorized hopper dredging interactions with threatened and/or endangered species in state waters, and that opinion (and its Incidental Take Statement) is still valid, *but only for the portion of the proposed Longboat Key dredging project's protected species interactions that may occur in state waters*. All protected species interactions resulting from any aspects of the proposed action that occur in state waters are under the sole jurisdiction and permitting authority of the COE, and are previously discussed and accounted for in the GRBO, whose proposed action includes "Federal, federally-permitted, or federally-sponsored hopper dredging of all U.S. Gulf of Mexico sand mining areas ("borrow sites") and virgin (previously unused) sand mining areas for beach nourishment, restoration, and protection projects, outside of designated Gulf sturgeon critical habitat, in state waters." By regulatory permit issued to the Town, the COE has authorized the Town a limited number of protected species interactions, based on the scope and timing of the action and Town compliance with the reasonable and prudent measures, and implementing terms and conditions, of the GRBO.

The effects and jeopardy analyses of the present opinion account for and analyze interactions that may result from the entire scope of the proposed action, but *only authorizes* the take of listed species that is expected to occur from activities in *federal* waters. Protected species interactions (lethal and non-lethal takes) in state waters fall under the GRBO.

Proposed Actions Occurring in State/Federal Waters in FY 11/12

Sand may be hopper-dredged from borrow area B3 (BAB3), borrow area IX (BAIX), and borrow area X (BAX), all located in state waters adjacent to Anna Maria Island (located just northwest and west of Longboat Key). In total, approximately 310,000 cy of sand will be dredged from BAF2 (the only borrow area in federal waters) and BAB3 and will be placed on Longboat Key in FY 11/12. Although up to 131,500 cy of sand could be dredged from BAB3 in FY 11/12, it is anticipated at this time that only 70,500 cy will be dredged (the remaining 239,500 cy will be dredged from BAF2 in federal waters).

Proposed Actions Occurring in State/Federal Waters in FY 13/14
In total, approximately 865,000 cubic yards of sand dredged from both federal and state waters, and sand obtained from upland sources, will be placed on Longboat Key in FY 13/14. Although up to 227,000 cy may be dredged from BAF2 (federal waters), at this time it is anticipated that only 100,000 cy will be dredged from BAF2 for the FY 13/14 project. The remaining 765,000 cy will come from state waters (BAIX and BAX (565,000 cy)) and from upland sources (200,000).

Conservation Measures that will be Implemented by BOEM and the COE in Federal and State Waters
Conservation actions that must occur during hopper dredging in state waters are laid out in the reasonable and prudent measures, and implementing terms and conditions, of the 2003 GRBO (as amended through Revision 2, dated January 9, 2007) to the COE; *identical conservation actions* are proposed to be implemented by BOEM for hopper dredging in federal waters. The GRBO is included as Appendix 1 of this document, for ease of reference. Revision 2 of the GRBO is included as Appendix 2. In addition, during dredging activities, the Town has agreed to comply with the NMFS' *Sea Turtle and Smalltooth Sawfish Construction Conditions*, included as Appendix 3 of this opinion. As part of these conditions, if a smalltooth sawfish or sea turtle is observed within 100 yards of construction operations, appropriate precautions shall be implemented to ensure protection of the species, including cessation of operation if an animal moves within 50 ft of any moving equipment. Additionally, the conditions require avoiding collisions with swimming sea turtles, operation at "no wake/idle" speeds in the construction area, and reporting any collision with and/or injury to a sea turtle to NMFS' Protected Resources Division and the local sea turtle stranding/rescue organization (in this case, Mote Marine Laboratory).

To reduce potential impacts from project lighting, the Town will limit direct lighting to immediate construction areas during sea turtle nesting season (April 1 – September 30). Lighting on offshore and onshore equipment shall be minimized through reduction, shielding, lowering, and appropriate light placement to avoid excessive illumination of the water's surface and nesting beach. Further, light intensity will be lowered to the minimum standard required by OSHA for General Construction areas in order to not misdirect sea turtles.

Additionally, protected species observers will live aboard the dredges, monitoring dredge loads 24-hours a day for evidence of impacts to endangered and threatened species, as well as recording water temperatures, bycatch information, and any sightings of species in the area. Hopper dredges will be required to have rigid turtle deflectors installed on all dragheads; deflector designs not previously approved by NMFS will not be allowed. Screening will be placed on all points of inflow prior to work beginning. Finally, relocation trawling will occur at the dredge site and any captured turtles will be photographed, measured, tagged, biopsied for future genetic analyses by NMFS, and released at least 3 nautical miles away. Relocation trawling will begin 24 hours prior to dredging operations with one trawling vessel operating 24 hours/day, 7 days/week. Relocation trawling will only cease if dredging operations are shut down. Tow times during relocation trawling will be strictly limited to less than 42 minutes total time.

Action Area
"Action area" means all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action area (50 CFR 402.02). The action area ranges from the onshore area of R44 in Manatee County south to R29 in Sarasota County, seaward from the northern-most borrow area, BAX, to the western-most borrow area, BAF2, south to New Pass (Figure 1.1). This area will encompass all areas expected to be impacted directly or indirectly by the proposed project. No areas south of New Pass are expected to be impacted by the project due to the sink effect of the pass on sediment transport; no impacts west of BAF2 are expected because of the currents/wave patterns in the area. Any onshore impacts will be limited to the beach area being renourished, ranging from marker R44 in Manatee County to R29 in Sarasota County.

3.0 Status of the Species

Much of the information for this section, as well as additional detailed information relating to the species biology, habitat requirements, threats, and recovery objectives, can be found in the recovery plan for each species (see "References Cited" section). The following listed species under our jurisdiction are known to occur in the Gulf of Mexico:

<u>Endangered</u>	
Green sea turtle[2]	*Chelonia mydas*
Leatherback sea turtle	*Dermochelys coriacea*
Hawksbill sea turtle	*Eretmochelys imbricata*
Kemp's ridley sea turtle	*Lepidochelys kempii*
Sperm whale	*Physeter macrocephalus*
Humpback whale	*Megaptera novaeangliae*
Fin whale	*Balaenoptera physalus*
Blue whale	*Balaenoptera musculus*
Sei whale	*Balaenoptera borealis*
North Atlantic right whale	*Eubalaena glacialis*
Smalltooth sawfish	*Pristis pectinata*
<u>Threatened</u>	
Loggerhead sea turtle[3]	*Caretta caretta*
Gulf sturgeon	*Acipenser oxyrinchus desotoi*

[2]Green turtles are listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are listed as endangered.

[3] Northwest Atlantic Ocean DPS (Distinct Population Segment)

3.1 Species Not Likely to be Adversely Affected

We believe that Gulf sturgeon and whales are not likely to be adversely affected by the proposed dredging, beach nourishment, and associated relocation trawling activities. Gulf sturgeon occur in the Gulf of Mexico, but the proposed action occurs south of their known range in the Gulf (the southern extent of their range ends at the Suwannee River) thus they are not likely to be adversely affected. Sperm whales (*Physeter macrocephalus*) occur in the Gulf of Mexico but are rare in inshore waters (such as the project area) and are unlikely to be adversely affected. Other endangered whales, including North Atlantic right whales (*Eubalaena glacialis)* and humpback whales (*Megaptera novaeangliae*) have been observed occasionally in the Gulf of Mexico. The individuals observed have likely been inexperienced juveniles straying from the normal range of these stocks. We believe there are no resident stocks of these species in the Gulf of Mexico, and these species are not likely to be adversely affected by projects in the Gulf. We believe that blue, fin, and sei whales (*Balaenoptera musculas*, *B. physalus*, and *B. borealis*, respectively) are not likely to be adversely affected by hopper dredging operations; the possibility of dredge collisions is remote since these are deepwater, pelagic, outer continental shelf species unlikely to be found near hopper dredging sites. There has never been a report of a lethal, whale interaction by a hopper dredge, although in February 2005 off the Brunswick Harbor Entrance Channel, Georgia, a hopper dredge did strike and injure a whale, thought by the onboard endangered species observer to be a North Atlantic right whale from the shape of the pectoral flippers (C. Slay, Coastwise Consulting, pers. comm. to B. Zoodsma, NMFS, February 24, 2005). Based on the unlikelihood of their presence, the above-mentioned cetaceans are not considered further in this opinion.

3.2 Species Likely to be Adversely Affected

We believe that five species of sea turtles and the smalltooth sawfish may be adversely affected by the proposed dredging, beach nourishment, or associated relocation trawling activities.

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 1991, Seminoff 2004, NMFS and USFWS 2007a). In 1978, the Atlantic population of the green sea turtle was listed as threatened under the ESA, except for the breeding populations in Florida and on the Pacific coast of Mexico, which were listed as endangered.

3.2.1.1 Pacific Ocean

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

They were also commercially exploited and this, coupled with habitat degradation, led to their decline in the Pacific (NMFS and USFWS 1998a). Green turtles in the Pacific continue to be affected by poaching, habitat loss or degradation, fishing gear interactions, and fibropapillomatosis (NMFS and USFWS 1998a, NMFS 2004).

Hawaiian green turtles are genetically distinct and geographically isolated, and the population appears to be increasing in size despite the prevalence of fibropapilloma and spirochidiasis (Aguirre et al. 1998 in Balazs and Chaloupka 2003). The East Island nesting beach in Hawaii is showing a 5.7 percent annual growth rate over 25 plus years (Chaloupka et al. 2007). In the Eastern Pacific, mitochondrial DNA analysis has indicated that there are three key nesting populations: Michoacán, Mexico; Galapagos Islands, Ecuador; and Islas Revillagigedos, Mexico (Dutton 2003). The number of nesting females per year exceeds 1,000 females at each site (NMFS and USFWS 2007a). However, historically, greater than 20,000 females per year are believed to have nested in Michoacán alone (Cliffton et al. 1982, NMFS and USFWS 2007a). Thus, the current number of nesting females is still far below what has historically occurred. There is also sporadic green turtle nesting along the Pacific coast of Costa Rica. At least a few of the non-Hawaiian nesting stocks in the Pacific have recently been found to be undergoing long-term increases. Datasets 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). 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 during which they are associated with drift lines of algae and other debris. At approximately 20- to 25-cm carapace length, juveniles leave pelagic habitats and enter benthic foraging areas (Bjorndal 1997).

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

Green sea turtle foraging areas in the southeastern United States include any coastal shallow waters having macroalgae or seagrasses. This includes areas near mainland coastlines, islands, reefs, or shelves, as well as open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (Hirth 1997, NMFS and USFWS 1991). Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre and the Gulf inlets of Texas (Doughty 1984, Hildebrand 1982, Shaver 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957, Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon system in Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward Counties (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 Lagoon and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Caribbean coast of Panama, the Miskito Coast in Nicaragua, and scattered areas along Colombia and Brazil (Hirth 1997). The summer developmental habitat for green turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus 1997).

Population Dynamics and Status

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

By far, the most important nesting concentration for green turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007a). Nesting in the area has increased considerably since the 1970s, and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007a). The number of females nesting per year on beaches in the Yucatán, Aves Island, Galibi Reserve, and Isla Trindade number in the hundreds to low thousands, depending on the site (NMFS and USFWS 2007a). The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Meylan et al. 1995, Johnson and Ehrhart 1994). Green sea turtle nesting in Florida has been increasing since 1989 (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute Index Nesting Beach Survey Database). Certain Florida nesting beaches have been designated index beaches. Index beaches were established to standardize data collection methods and effort on key nesting beaches. Since establishment of the index beaches in 1989, the pattern of green turtle nesting shows biennial peaks in abundance with a generally positive trend during the ten years of regular monitoring. This is perhaps due to increased protective legislation throughout the Caribbean (Meylan et al. 1995). A total statewide average (all beaches, including index beaches) of 5,039 green turtle nests were laid annually in Florida between 2001 and 2006, with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a). Data from the index nesting beaches program in Florida substantiate the dramatic increase in nesting. In 2007, there were 9,455 green turtle nests found just on index nesting beaches, the highest since index beach monitoring began in 1989. The number fell back to 6,385 in 2008, further dropping under 3,000 in 2009, but that consecutive drop was a temporary deviation from the normal biennial nesting cycle for green turtles, as 2010 saw an increase back to 8,426 nests on the index nesting beaches (FWC Index Nesting Beach Survey Database). 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. In 2010, a total of 18 nests were found in North Carolina, 6 nests in South Carolina, and 6 nests in Georgia (nesting databases maintained on www.seaturtle.org). Increased nesting has also been observed along the Atlantic coast of Florida, on beaches where only loggerhead nesting was observed in the past (Pritchard 1997). Recent modeling by Chaloupka et al. (2007) using data sets of 25 years or more has resulted in an estimate of the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9 percent, and the Tortuguero, Costa Rica, population growing at 4.9 percent annually.

There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas of the southeastern United States, where they come to forage. However, information on incidental captures of immature green sea turtles at the St. Lucie Power Plant in St. Lucie County, Florida, shows that the annual number of immature green sea turtles captured by their offshore cooling water intake structures has increased significantly over the years. Green sea turtle annual captures averaged 19 for 1977-1986, 178 for 1987-1996, and 262 for 1997-2001 (FPL 2002). In the five years from 2002-2006, green sea turtle captures averaged 333 per year, with a high of 427 and a low of 267 (FPL and Quantum Resources 2007). More recent unpublished data shows 101 captures in 2007, 299 in 2008, 38 in 2009 (power output was cut—and cooling water intake concomitantly reduced—for part of that year) and 413 in 2010. Ehrhart et al. (2007) has also documented a significant increase in in-water abundance of green turtles in the Indian River Lagoon area. It is likely that immature green sea turtles foraging in the southeastern United States come from multiple genetic stocks; therefore, the status of immature green sea turtles in the southeastern United States might also be assessed from trends at all of the main regional nesting beaches, principally Florida, Yucatán, and Tortuguero.

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of green sea turtles for food and other products. Although intentional poachingof 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. In 2010, there was a massive oil well release in the Gulf of Mexico at British Petroleum's Deepwater Horizon well. Official estimates are that 4.9 million barrels of oil were released into the Gulf, with some experts estimating even higher volumes. At this time the assessment of total direct impact to sea turtles has not been determined. Additionally, the long-term impacts to sea turtles as a result of habitat impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known. Sea sampling coverage in the pelagic driftnet, pelagic longline, Southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded interactions with 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). Other sources of natural mortality include cold-stunning and biotoxin exposure. Cold-stunning is not considered a major source of mortality in most cases. As temperatures fall below 8°-10°C, turtles may lose their ability to swim and dive, often floating to the surface. The rate of cooling that precipitates cold-stunning appears to be the primary threat, rather than the water temperature itself (Milton and Lutz 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold-stunning because temperature changes are most rapid in shallow water (Witherington and Ehrhart 1989). During January 2010, an unusually large cold-stunning event in the southeastern United States resulted in around 4,600 sea turtles, mostly greens, found cold-stunned, with hundreds found dead, or dying after they were gathered. Another cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1,500 green turtles found cold-stunned off Texas, and another 300 or so off Mexico, with an as yet undetermined number found dead or dying after they were found.

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

Impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty; however, significant impacts to the hatchling sex ratios of green turtles may result (NMFS and USFWS 2007a). In marine turtles, sex is determined by temperature in the middle third of incubation, with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward 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 (Glen 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 is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increased frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

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

3.2.1.4 Summary of Status for Atlantic Green Sea Turtles

Green turtles range in the western Atlantic from Massachusetts to Argentina, including the Gulf of Mexico and the Caribbean Sea, but are considered rare in benthic areas north of Cape Hatteras (Wynne and Schwartz 1999). Green turtles face many of the anthropogenic threats for other sea turtles described herein. In addition, green turtles are also susceptible to fibropapillomatosis, which can result in death. In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart 1979). Recent population estimates for the western Atlantic area are not available. The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the almost 20 years of regular monitoring since establishment of index beaches in Florida in 1989.

3.2.2 Hawksbill Sea Turtle

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

3.2.2.1 Pacific Ocean

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

3.2.2.2 Atlantic Ocean

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

Life History and Distribution

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

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

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

Population Dynamics and Status

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

Threats

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

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

Impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty; however, significant impacts to the hatchling sex ratios of hawksbill turtles may result (NMFS and USFWS 2007d). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward a higher numbers of females (NMFS and USFWS 2007d).

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

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

3.2.2.3 Summary of Status for Hawksbill Sea Turtles

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

3.2.3 Kemp's Ridley Sea Turtle

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

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

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

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

Population Dynamics and Status

Of the seven extant species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the Rancho Nuevo beaches (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s, nesting numbers were below 1,000 (with a low of 702 nests in 1985). However, observations of increased nesting (with 6,277 nests recorded in 2000) suggest that the decline in the ridley population has stopped and the population is now increasing (USFWS 2000). The number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3 percent per year from 1985 to 1999 (TEWG 2000). These trends are further supported by 2004-2007 nesting data from Mexico. The number of nests over that period has increased from 7,147 in 2004, to 10,099 in 2005, to 12,143 in 2006, and 15,032 during the 2007 nesting season (Gladys Porter Zoo nesting database 2007). In 2008, there were 17,882 nests in Mexico (Gladys Porter Zoo 2008), and nesting in 2009 reached 21,144 (Gladys Porter Zoo 2010). In 2010, nesting declined significantly, to 13,302 (Gladys Porter Zoo 2010). Final numbers for 2011were not available at the time of this opinion; however, preliminary information for Kemp's ridley nesting in Mexico indicates there were fewer nests than in 2009, but nesting numbers did rebound from 2010's reduced nesting to over 20,000 (pers. comm. Jaime Peña, Gladys Porter Zoo). A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 128 in 2007, 195 in 2008, and 197 in 2009. Texas nesting then experienced a decline similar to that seen in Mexico for 2010, with 140 nests (National Park Service data, http://www.nps.gov/pais/naturescience/strp.htm), but nesting rebounded in 2011 with a record 199 nests (National Park Service data, http://www.nps.gov/pais/naturescience/current-season.htm).

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

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

Threats

Kemp's ridleys face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, natural predators at sea, and oceanic events such as cold-stunning. Although cold-stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. For example, in the winter of 1999-2000, there was a major cold-stunning event where 218 Kemp's ridleys, 54 loggerheads, and 5 green sea turtles were found on Cape Cod beaches (R. Prescott, NMFS, pers. comm. 2001). Annual cold-stunning events do not always occur at this magnitude; the extent of episodic major cold-stun events may be associated with numbers of sea turtles utilizing Northeast waters in a given year, oceanographic conditions, and the occurrence of storm events in the late fall. Many cold-stunned sea turtles can survive if found early enough, but cold-stunning events can still represent a significant cause of natural mortality. A complete list of other indirect factors can be found in NMFS SEFSC (2001).

Although changes in the use of shrimp trawls and other trawl gear have helped to reduce mortality of Kemp's ridleys, this species is also affected by other sources of anthropogenic impacts similar to those discussed in previous sections. For example, in the spring of 2000, a total of 5 Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. Cause of death for most of the sea turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gillnet fishery operating offshore in the preceding weeks. The 5 Kemp's ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction because it is unlikely that all of the carcasses washed ashore.

The impacts of pollution on Kemp's ridley sea turtles, as with all sea turtles, are still poorly understood. There is little data to provide an understanding of how water quality impacts sea turtles. In 2010, there was a massive oil well release in the Gulf of Mexico at British Petroleum's Deepwater Horizon well. Official estimates are that 4.9 million barrels of oil were released into the Gulf, with some experts estimating even higher volumes. At this time the assessment of total direct impact to sea turtles has not been determined. Additionally, the long-term impacts to sea turtles as a result of habitat impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known.

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

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

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

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

3.2.3.1 Summary of Kemp's Ridley Status

The only major nesting site for Kemp's ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963). The number of nests observed at Rancho Nuevo and nearby beaches increased from 1985 to 2008. Nesting has also exceeded 12,000 nests per year from 2004-2010 (Gladys Porter Zoo database). Kemp's ridleys mature at an earlier age (7-15 years) than other chelonids; thus, "lag effects" as a result of unknown impacts to the non-breeding life stages would likely have been seen in the increasing nest trend beginning in 1985 (USFWS and NMFS 1992).

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

3.2.4 Northwest Atlantic Ocean DPS of 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 interactions (i.e., poaching), incidental capture in various fisheries, and the alteration and destruction of its habitat. Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. The majority of loggerhead nesting occurs in the Western Atlantic Ocean (south Florida, United States), and the western Indian Ocean (Masirah, Oman); in both locations nesting assemblages have more than 10,000 females nesting each year (NMFS and USFWS 2008). Loggerhead sea turtles are the most abundant species of sea turtle in U.S. waters.

On March 16, 2010, NMFS and the USFWS published a proposed rule in the Federal Register to list nine Distinct Population Segments (DPSs) of loggerhead sea turtles as endangered or threatened under the ESA (75 FR 12598). The proposed rule represented NMFS' and USFWS' 12-month findings on petitions to list North Pacific populations and Northwest Atlantic populations as endangered and included a proposed rule to designate nine DPSs worldwide. In the final rule, issued on September 16, 2011, retaining their proposed status, five DPSs were listed as endangered and four others were listed as threatened. This opinion considers the Northwest Atlantic Ocean DPS of loggerhead sea turtles, listed as threatened under the ESA.

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 29°N on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the Eastern Yucatán Peninsula, Mexico (Márquez 1990 and TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS 2001b). The recently published recovery plan for the Northwest Atlantic population of loggerhead sea turtles concluded, based on recent advances in genetic analyses, that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula and that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are: (1) the Northern Recovery Unit (Florida/Georgia border north through southern Virginia); (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida); (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida); (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas); and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 2008). The recovery plan concluded that all recovery units are essential to the recovery of the species.

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 (sea turtles that have come back

to inshore and nearshore waters)—the life stage following the pelagic immature stage—lasting from 14-32 years.

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

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

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

Population Dynamics and Status

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

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

Annual nest totals from beaches within what NMFS and USFWS have defined as the Northern Recovery Unit (NRU) averaged 5,215 nests from 1989-2008, a period of near-complete surveys of NRU nesting beaches (GDNR unpublished data, NCWRC unpublished data, SCDNR unpublished data), and represent approximately 1,272 nesting females per year (4.1 nests per female, Murphy and Hopkins 1984). The loggerhead nesting trend from daily beach surveys showed a significant decline of 1.3 percent annually. Nest totals from aerial surveys conducted by SCDNR showed a 1.9 percent annual decline in nesting in South Carolina since 1980. Overall, there is strong statistical data to suggest the NRU has experienced a long-term decline. Data in 2008 has shown improved nesting numbers, but future nesting years will need to be analyzed to determine if a change in trend is occurring. In 2008, 841 loggerhead nests were observed compared to the 10-year average of 715 nests in North Carolina. The number dropped to 276 in 2009, but rose again to 846 in 2010. In South Carolina, 2008 was the seventh highest nesting year on record since 1980, with 4,500 nests, but this did not change the long-term trend line indicating a decline on South Carolina beaches. Then in 2009 nesting dropped to 2183, with an increase to 3,141 in 2010. Georgia beach surveys located a total of 1,648 nests in 2008. This number surpassed the previous statewide record of 1,504 nests in 2003. In 2009, the number of nests declined to 998, and in 2010, a new statewide record was established with 1,760 loggerhead nests. According to analyses by Georgia DNR, the 40-year time-series trend data show an overall decline in nesting, but the shorter comprehensive survey data (20 years) indicate a stable population (SCDNR 2008; GDNR, NCWRC, and SCDNR nesting data located at www.seaturtle.org).

Another consideration that may add to the importance and vulnerability of the NRU is the sex ratio 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 (all beaches including index nesting beaches) undertaken from 1989 to 2007 showed a mean of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (from NMFS and USFWS 2008). The statewide estimated total for 2010 was 73,702 (FWRI nesting database). An analysis of index nesting beach data shows a 26 percent decline in nesting by the PFRU between 1989 and 2008, and a mean annual rate of decline of 1.6 percent despite a large increase in nesting for 2008, to 38,643 nests (Witherington et al. 2009, NMFS and USFWS 2008, FWRI nesting database). In 2009, nesting levels, while still higher than the lows of 2004, 2006, and 2007, dropped below 2008 levels to approximately 32,717 nests, but in 2010 a large increase was seen, with 47,880 nests on the index nesting beaches (FWRI nesting database). The 2010 index nesting number is the largest since 2000.

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

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

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

The results of one set of model runs suggest that the western North Atlantic population is most likely declining, but this result was very sensitive to the choice of the position of the parameters within their range and hypothesized distributions. This example was run to predict the distribution of projected population trajectories for benthic females using a range of starting population numbers from the 30,000 estimated minimum to the greater than the 300,000 likely upper end of the range and declining trajectories were estimated for all of the population estimates. After 10,000 simulation runs of the models using the parameter ranges, 14 percent of the runs resulted in growing populations, while 86 percent resulted in declining populations. While this does not translate to an equivalent statement that there is an 86 percent chance of a declining population, it does illustrate that given the life history parameter information currently thought to comprise the likely range of possibilities, it appears most likely that with no changes to those parameters the population is projected to decline. Additional model runs using the range of values for each life history parameter, the assumption of non-uniform distribution for those parameters, and a 5 percent natural (non-anthropogenic) mortality for the benthic stages resulted in a determination that a 60-70 percent reduction in anthropogenic mortality in the benthic stages would be needed to bring 50 percent of the model runs to a static (zero growth or decline) or increasing trajectory.

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

Threats

The 5-year status review of loggerhead sea turtles recently completed by NMFS and the USFWS provides a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and USFWS 2007c). The Loggerhead Recovery Team also undertook a comprehensive evaluation of threats to the species, and described them separately for the terrestrial, neritic, and oceanic zones (NMFS and USFWS 2008). The diversity of sea turtles' life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the benthic environment, and in the pelagic environment. Hurricanes are particularly destructive to sea turtle nests. Sand accretion and rainfall that result from these storms, as well as wave action, can appreciably reduce hatchling success. For example, in 1992 all of the eggs over a 90-mile length of coastal Florida were destroyed by storm surges on beaches that were closest to the eye of Hurricane Andrew (Milton et al. 1994). Also, many nests were destroyed during the 2004 and 2005 hurricane seasons. Other sources of natural mortality include cold-stunning and biotoxin exposure. Cold-stunning is not considered a major source of mortality, but cold-stunning of loggerhead turtles has been reported at several locations in the northeast and southeast United States, including the Indian River Lagoon in Florida (Mendonca and Ehrhart 1982, Witherington and Ehrhart 1989) and Texas inshore waters (Hildebrand 1982). Cold-stunning is a phenomenon during which turtles become incapacitated as a result of rapidly dropping water temperatures (Witherington and Ehrhart 1989, Morreale et al. 1992). As temperatures fall below 8°-10°C, turtles may lose their ability to swim and dive, often floating to the surface. The rate of cooling that precipitates cold-stunning appears to be the primary threat, rather than the water temperature itself (Milton and Lutz 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold-stunning because temperature changes are most rapid in shallow water (Witherington and Ehrhart 1989). In January 2010, an unusually large cold-stunning event occurred throughout the southeast United States, with well over 3,000 sea turtles (mostly greens but also hundreds of loggerheads) found cold-stunned. Most were able to be saved, but a few hundred were found dead or died after being discovered in a cold-stunned state.

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 East Florida nesting beaches from Indian River to Broward County, including some high density beaches, 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 threats include oil and gas exploration, coastal development, marine transportation, marine pollution (which may have a direct impact, or an indirect impact by causing harmful algal blooms), underwater explosions, hopper dredging, offshore artificial lighting, power plant entrainment and/or impingement, entanglement in debris, ingestion of marine debris, marina and dock construction and operation, boat collisions, poaching, and fishery interactions. In 2010, there was a massive oil well release in the Gulf of Mexico at British Petroleum's Deepwater Horizon well. Official estimates are that 4.9 million barrels of oil were released into the Gulf, with some experts estimating much higher volumes. At this time the assessment of total direct impact to sea turtles has not been determined. Additionally, the long-term impacts to sea turtles as a result of habitat impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known. Loggerheads in the pelagic environment are exposed to a series of longline fisheries, which include the highly migratory species' Atlantic pelagic longline fisheries, an Azorean longline fleet, a Spanish longline fleet, and various longline fleets in the Mediterranean Sea

(Aguilar et al. 1995, Bolten et al. 1994). Loggerheads in the benthic environment in waters off the coastal United States are exposed to a suite of fisheries in federal and state waters including trawl, purse seine, hook-and-line, gillnet, pound net, longline, and trap fisheries. The sizes and reproductive values of sea turtles killed or injured 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 interacts with greater numbers of less reproductively valuable turtles if the fishery removes a higher overall reproductive value from the population (Wallace et al. 2008). The Loggerhead Biological Review Team determined that the greatest threats to the Northwest Atlantic DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant, et al. 2009). Attaining a more thorough understanding of the characteristics, as well as the quantity, of sea turtle bycatch across all fisheries is of great importance.

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

Impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty; however significant impacts to the hatchling sex ratios of loggerhead turtles may result (NMFS and USFWS 2007c). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007c). Modeling suggests an increase of 2°C in air temperature would result in a sex ratio of over 80 percent female offspring for loggerheads nesting near Southport, North Carolina. The same increase in air temperatures at nesting beaches in Cape Canaveral, Florida, would result in close to 100 percent female offspring. More ominously, an air temperature increase of 3°C is likely to exceed the thermal threshold of most clutches, leading to death (Hawkes et al. 2007).

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

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

Other changes in the marine ecosystem caused by global climate change (e.g., 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 recurring sources of mortality of sea turtles in the environmental baseline and improving the status of all loggerhead subpopulations. For example, the Turtle Excluder Device (TED) regulation published on February 21, 2003 (68 FR 8456), represents a significant improvement in the baseline effects of trawl fisheries on loggerhead sea turtles, though shrimp trawling is still considered to be one of the largest source of anthropogenic mortality on loggerheads (NMFS SEFSC 2009).

3.2.4.1 Summary of Status for Loggerhead Sea Turtles

In the Atlantic Ocean, absolute population size is not known, but based on extrapolation of nesting information, loggerheads are likely much more numerous than in the Pacific Ocean. NMFS recognizes five recovery units of loggerhead sea turtles in the western North Atlantic based on genetic studies and management regimes. Cohorts from all of these are known to occur within the action area of this consultation. There are long-term declining nesting trends for the two largest Western Atlantic recovery units: the PFRU and the NRU. Furthermore, no long-term data suggest any of the loggerhead subpopulations throughout the entire North Atlantic are increasing in annual numbers of nests (TEWG 2009). Additionally, using both computation of susceptibility to quasi-extinction and stage-based deterministic modeling to determine the effects of known threats to Northwest Atlantic loggerheads, the Loggerhead Biological Review Team determined that this population is likely to decline in the foreseeable future, driven primarily by the mortality of juvenile and adult loggerheads from fishery bycatch throughout the North Atlantic Ocean. These computations were done for each of the recovery units, and all of them resulted in an expected decline (Conant et al. 2009). Because of its size, the PFRU may be critical to the survival of the species in the Atlantic Ocean. In the past, this nesting aggregation was considered second in size only to the nesting aggregation on islands in the Arabian Sea off Oman (Ross 1979, Ehrhart 1989). 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 convened a Loggerhead Biological Review Team that determined that loggerhead turtles in the Atlantic meet the required characteristics to be separated into three DPSs: the Northwest Atlantic DPS, Northeast Atlantic DPS, and South Atlantic DPS (Conant et al. 2009). On March 10, 2010, NMFS and USFWS announced their proposed determination that loggerhead sea turtles should be listed as nine separate DPSs, and that seven of these, including Northwest Atlantic loggerheads, should be listed as endangered. In the final rule, issued on September 16, 2011, five DPSs were listed as endangered – Northeast Atlantic Ocean, Mediterranean Sea, North Indian Ocean, North Pacific Ocean, and South Pacific Ocean; and four others were listed as threatened – Northwest Atlantic Ocean, South Atlantic Ocean, Southeast Indo-Pacific Ocean, and Southwest Indian Ocean. All loggerhead DPSs are faced with a multitude of natural and anthropogenic effects that negatively influence the status of the species. Many anthropogenic effects occur as a result of activities outside of U.S. jurisdiction (i.e., fisheries in international waters).

3.2.5 Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its global range on June 2, 1970. Leatherbacks are widely distributed throughout the oceans of the world and are found in waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972). Leatherback sea turtles are the largest living turtles and range farther than any other sea turtle species. The large size of adult leatherbacks and their tolerance to relatively low temperatures allows them to occur in northern waters such as off Labrador and in the Barents Sea (NMFS and USFWS 1995). Adult leatherbacks forage in temperate and subpolar regions from 71°N to 47°S latitude in all oceans and undergo extensive migrations to and from their tropical nesting beaches. In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982); that number, however, is probably an overestimation as it was based on a particularly good nesting year in 1980 (Pritchard 1996). By 1995, the global population of adult females had declined to 34,500 (Spotila et al. 1996). Pritchard (1996) also called into question the population estimates from Spotila et al. (1996) and felt they may be somewhat low because it ended the modeling on data from a particularly bad nesting year (1994) while excluding nesting data from 1995, which was a good nesting year. The most recent population estimate for leatherback sea turtles from just the North Atlantic breeding groups is a range of 34,000-90,000 adult individuals (20,000-56,000 adult females) (TEWG 2007).

3.2.5.1 Pacific Ocean

Based on published estimates of nesting female abundance, leatherback populations have collapsed or have been declining at all major Pacific basin nesting beaches for the last two decades (Spotila et al. 1996, NMFS and USFWS 1998b, Sarti et al. 2000, Spotila et al. 2000). For example, the nesting assemblage on Terengganu, Malaysia–which was one of the most significant nesting sites in the western Pacific Ocean–has declined severely from an estimated 3,103 females in 1968 to 2 nesting females in 1994 (Chan and Liew 1996). Nesting assemblages of leatherback turtles are in decline along the coasts of the Solomon Islands, a historically important nesting area (D. Broderick, pers. comm., in Dutton et al. 1999). In Fiji, Thailand, Australia, and Papua New Guinea (East Papua), leatherback turtles have only been known to nest in low densities and scattered colonies.

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

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

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

Although all causes of the declines in leatherback turtle colonies in the eastern Pacific have not been documented, Sarti et al. (1998) suggest that the declines result from egg poaching, adult and subadult mortalities incidental to high seas fisheries, and natural fluctuations due to changing environmental conditions. Some published reports support this suggestion. Sarti et al. (2000)

reported that female leatherback turtles have been killed for meat on nesting beaches like Píedra de Tiacoyunque, Guerrero, Mexico. Eckert (1997) reported that swordfish gillnet fisheries in Peru and Chile contributed to the decline of leatherback turtles in the eastern Pacific. The decline in the nesting population at Mexiquillo, Mexico, occurred at the same time that effort doubled in the Chilean driftnet fishery. In response to these effects, the eastern Pacific population has continued to decline, leading some researchers to conclude that the leatherback is on the verge of extinction in the Pacific Ocean (e.g., Spotila et al. 1996, Spotila et al. 2000). The NMFS assessment of three nesting aggregations in its February 23, 2004, opinion supports this conclusion: If no action is taken to reverse their decline, leatherback sea turtles nesting in the Pacific Ocean either have high risks of extinction in a single human generation (for example, nesting aggregations at Terrenganu and Costa Rica) or they have a high risk of declining to levels where more precipitous declines become almost certain (e.g., Irian Jaya) (NMFS 2004).

3.2.5.2 Atlantic Ocean

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

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

Female leatherbacks nest frequently (up to 10 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and, thus, can produce 700 eggs or more per nesting season (Schultz 1975). However, a significant portion (up to approximately 30 percent) of the eggs can be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. The eggs incubate for 55-75 days before hatching. Based on a review of all sightings of leatherback sea turtles of <145-cm curved carapace length (ccl), Eckert (1999) found that leatherback juveniles remain in waters warmer than 26°C until they exceed 100 ccl.

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

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

General differences in migration patterns and foraging grounds may occur between the seven nesting assemblages identified by the TEWG in 2007, but data is limited. Marked or satellite tracked turtles from the Florida and North Caribbean assemblages have been re-sighted off North America, in the Gulf of Mexico, and along the Atlantic coast, and a few have moved to western Africa, north of the equator. In contrast, Western Caribbean and Southern Caribbean/Guianas animals have been found more commonly in the eastern Atlantic, off Europe and northern Africa, as well as along the North American coast. There are no reports of marked animals from the Western North Atlantic assemblages entering the Mediterranean Sea or the South Atlantic Ocean, though in the case of the Mediterranean this may be due more to a lack of data rather than failure of Western North Atlantic turtles moving into the Sea. The tagging data coupled with the satellite telemetry data indicate that animals from the western North Atlantic nesting subpopulations use virtually the entire North Atlantic Ocean. In the South Atlantic Ocean, tracking and tag return data follow three primary patterns. Although telemetry data from the West African nesting assemblage showed that all but one remained on the shallow continental shelf, there clearly is movement to foraging areas of the south coast of Brazil and Argentina. There is also a small nesting aggregation of leatherbacks in Brazil, and while data are limited to a few satellite tracks, these turtles seem to remain in the southwest Atlantic foraging along the continental shelf margin as far south as Argentina. South African nesting turtles apparently forage primarily south, around the tip of the continent.

Population Dynamics and Status

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

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

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

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

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800-900 per year in the 2000s following nesting totals fewer than 100 nests per year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the index nesting beach surveys, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17 percent between 1989 and 2005. In 2007, a record 517 leatherback nests were observed on the index beaches in Florida, with 265 in 2008, and then an increase to a new record of 615 nests in 2009, and a slight decline in 2010 back to 552 nests (FWC Index Nesting Beach database). This up-and-down pattern is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting, but overall the trend shows rapid growth on Florida's east coast beaches.

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

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

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

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

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

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

Leatherbacks are also susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer et al. 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer et al. 2002). Fixed gear fisheries in the mid-Atlantic have also contributed to leatherback entanglements. In North Carolina, two leatherback sea turtles were reported entangled in a crab pot buoy inside Hatteras Inlet (D. Fletcher, pers. comm. to S. Epperly in NMFS 2001a). A third leatherback was reported entangled in a crab pot buoy in Pamlico Sound near Ocracoke. This turtle was disentangled and released alive; however, lacerations on the front flippers from the lines were evident (D. Fletcher, pers. comm. to S. Epperly in NMFS 2001a). In the Southeast, leatherbacks are vulnerable to entanglement in Florida's lobster pot and stone crab fisheries. In the U.S. Virgin Islands, where one of five leatherback strandings from 1982 to 1997 was due to entanglement (Boulon 2000), leatherbacks have been observed with their flippers wrapped in the line of West Indian fish traps (R. Boulon, pers. comm. to J. Braun-McNeill in NMFS 2001a). Because many entanglements of this typically pelagic species likely go unnoticed, entanglements in fishing gear may be much higher.

Leatherback interactions with the Southeast Atlantic shrimp fishery, which operates predominately from North Carolina through southeast Florida (NMFS 2002), have also been a common occurrence. Leatherbacks, which migrate north annually, are likely to encounter shrimp trawls working in the coastal waters off the Atlantic coast from Cape Canaveral, Florida, to the Virginia/North Carolina border. Leatherbacks also interact with the Gulf of Mexico shrimp fishery. For many years, TEDs required for use in these fisheries were less effective at excluding leatherbacks than the smaller, hard-shelled turtle species. To address this problem, on February 21, 2003, the NMFS issued a final rule to amend the TED regulations, which required modifications to the size and design of TEDs to exclude leatherbacks and large and sexually mature loggerhead and green turtles. Mortality of leatherbacks in the shrimp fishery is now estimated at 54 turtles per year.

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

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

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

Pollution may also represent a significant problem for leatherback sea turtles. Leatherback sea turtles may be more susceptible to marine debris ingestion than other species due to their pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding areas and migratory routes (Lutcavage et al. 1997, Shoop and Kenney 1992). Investigations of the stomach contents of leatherback sea turtles revealed that a substantial percentage (44 percent of the 16 cases examined) contained plastic (Mrosovsky 1981). Along the coast of Peru, intestinal contents of 19 of 140 (13 percent) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that the object might resemble a food item by its shape, color, size, or even movement as it drifts about, and induce a feeding response in leatherbacks. In 2010, there was a massive oil well release in the Gulf of Mexico at British Petroleum’s Deepwater Horizon well. Official estimates are that 4.9 million barrels of oil were released into the Gulf, with some experts estimating even higher volumes. At this time the assessment of total direct impact to sea turtles has not been determined. Additionally, the long-term impacts to sea turtles as a result of habitat impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known.

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

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

Impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty; however, significant impacts to the hatchling sex ratios of leatherback turtles may result (NMFS and USFWS 2007b). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). However, unlike other sea turtles species, leatherbacks tend to select nest locations in the cooler tidal zone of beaches (Kamel and Mrosovsky 2004). This preference may help mitigate the effects from increased beach temperature (Kamel and Mrosovsky 2004).

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

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

3.2.5.3 Summary of Leatherback Status

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

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

3.2.6 The Deepwater Horizon MC252 Oil Release Event and Impacts to Sea Turtles in the Northern Gulf

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

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

During the initial response phase to the DWH oil spill (April 26 – October 20, 2010) a total of 1,146 sea turtles were recovered (Table 3.2.1), either as strandings (dead or debilitated generally onshore or nearshore) or were collected offshore during sea turtle search and rescue operations. Subsequent to the response phase a few sea turtles with visible evidence of oiling were recovered as strandings. The available data on sea turtle strandings and response collections during the time of the spill are expected to represent a fraction (currently unknown) of the actual losses to the species, as most individuals likely were not recovered. The number of strandings does not provide insights into potential sub-lethal impacts that could reduce long-term survival or fecundity of individuals affected. However, it does provide some insight into the potential relative scope of the impact among the sea turtle species in the area. Kemp's ridley sea turtles may have been the most affected sea turtle species, as they accounted for almost 71 percent of all recovered turtles (alive and dead), and 79 percent of all dead turtles recovered. Green turtles accounted for 17.5 percent of all recoveries (alive and dead), and 4.8 percent of the dead turtles recovered. Loggerheads comprised 7.7 percent of total recoveries (alive and dead) and 11 percent of the dead turtle recovered. The remaining turtles were hawksbills and decomposed hardshell turtles that were not identified to species. No leatherbacks were among the sea turtles recovered in the spill response area. (Note: leatherbacks were documented in the spill area, but they were not recovered alive or dead).

Kemp's Ridley Sea Turtles

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

Loggerhead Sea Turtles

As presented earlier, 88 loggerhead sea turtles were documented within the designated spill during response activities; 67 were dead and 21 were alive. As mentioned previously, it is unclear how many of those without direct evidence of oil were actually impacted by the spill and spill-related activities versus other sources of mortality. There were likely additional mortalities that were undetected and, therefore, currently unknown. Although we believe that the DWH event had adverse effects on loggerheads, the population level effect was not likely as severe as for Kemp's ridleys. In comparison to Kemp's ridleys, we believe the relative proportion of the loggerhead population exposed to the effects of the event was much smaller, the number of turtles recovered (alive and dead) was fewer in absolute numbers, and the overall population size is believed to be many times larger. Additionally, unlike Kemp's ridleys, the majority of nesting for the Northwest Atlantic Ocean loggerhead DPS occurs on the Atlantic coast. However, it is likely that impacts to the Northern Gulf of Mexico Recovery Unit of the NWA loggerhead DPS would be proportionally much greater than the impacts occurring to other recovery units because of impacts to nesting (as described above) and a larger proportion of the NGMRU recovery unit, especially mating and nesting adults, having been exposed to the spill. However, the impacts to that recovery unit, and the possible effect of such a disproportionate impact on that small recovery unit to the NWA DPS, remain unknown.

Green Sea Turtles

Green sea turtles comprised the second-most common species recovered during the DWH response. Of the 201 green turtles recovered, 29 were found dead or later died while undergoing rehabilitation. The mortality number is lower than that for loggerheads despite loggerheads having far fewer total strandings, but this is because the majority of green turtles came from the offshore rescue (pelagic stage), of which almost all turtles (of all species) survived after rescue, whereas a greater proportion of the loggerhead recoveries were nearshore neritic stage individuals found dead. While green turtles regularly use the northern Gulf of Mexico, they have a widespread distribution throughout the entire Gulf of Mexico, Caribbean, and Atlantic. As described in the Status of the Species section, nesting is relatively rare on the northern Gulf coast. Therefore, while it is expected that adverse impacts occurred, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event, and thus the population-level impact, is likely much smaller than for Kemp's ridleys.

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

3.2.7 Smalltooth Sawfish

The U.S. Distinct Population Segment (DPS) of smalltooth sawfish was listed as endangered under the ESA on April 1, 2003 (68 FR 15674). The smalltooth sawfish is the first elasmobranch to be listed in the United States. The recovery plan for the species was finalized in January 2009. Critical habitat for the species was designated on September 2, 2009 (74 FR 45353). The two units designated are located along the southwestern coast of Florida between Charlotte Harbor and Florida Bay. Historically, smalltooth sawfish occurred commonly in the inshore waters of the Gulf of Mexico and along the Eastern Seaboard up to North Carolina, and more rarely as far north as New York. Today, smalltooth sawfish remain in the United States typically in protected or sparsely populated areas off the southern and southwestern coasts of Florida though a nursery area has been established in the Caloosahatchee River in an area of waterfront residences and seawalls and adults and juveniles are not uncommon in the Florida Keys (NMFS 2010).

Life History and Distribution
Smalltooth sawfish are approximately 31 in (80 cm) in total length at birth and may grow to a length of 18 feet (540 cm) or greater. A recent study by Simpfendorfer (2008) suggests rapid juvenile growth occurs during the first two years after birth. First year growth is 26-33 in (65-85 cm) and second year growth is 19-27 in (48-68 cm). Growth rates beyond two years are uncertain; however, the average growth rate of captive smalltooth sawfish has been reported between 5.8 in (13.9 cm) and 7.7 in (19.6 cm) per year. Apart from captive animals, little is known of the species' age parameters (i.e., age-specific growth rates, age at maturity, and maximum age). Simpfendorfer (2000) estimated age at maturity between 10 and 20 years, and a

maximum age of 30 to 60 years. Simpfendorfer (2008) reported that males appear to mature between 100-150 in (253 - 381 cm) total length, and unpublished data from Mote Marine Laboratory (MML) and NMFS indicates male smalltooth sawfish do not reach maturity until they reach 133 in (340 cm) total length.

No directed research on smalltooth sawfish prey preferences exists. Reports of sawfish feeding habits suggest they subsist chiefly on small schooling fish, such as mullets and clupeids. They are also reported to feed on crustaceans and other bottom-dwelling organisms. Observations of sawfish feeding behavior indicate that they attack fish by slashing sideways through schools, and often impale the fish on their rostral (saw) teeth (Breder 1952). Recent research (Wueringer et al. 2012) suggests smalltooth sawfish use their rostrum for both prey detection and capture. The fish are subsequently scraped off the teeth by rubbing them on the bottom and then ingested whole. The oral teeth of sawfish are ray-like, having flattened cusps that are better suited to crushing or gripping.

Very little is known about the specific reproductive biology of the smalltooth sawfish. No confirmed breeding sites have been identified to date since directed research began in 1998. As with all elasmobranchs, fertilization occurs internally. Development in sawfish is believed to be ovoviparous. The embryos of smalltooth sawfish, while still bearing the large yolk sac, resemble adults relative to the position of their fins and absence of the lower caudal lobe. During embryonic development, the rostral blade is soft and flexible. The rostral teeth are also encapsulated or enclosed in a sheath until birth. Shortly after birth, the teeth become exposed and attain their full size, proportionate to the size of the saw. (Bigelow and Schroeder 1953) reported gravid females have been documented carrying between 15-20 embryos; however, the source of their data is unclear and may represent an over-estimate of litter size. Studies of largetooth sawfish in Lake Nicaragua (Thorson 1976) report brood sizes of 1-13 individuals, with a mean of 7 individuals. The gestation period for largetooth sawfish is approximately 5 months, and females likely produce litters every second year. Although there are no such studies on smalltooth sawfish, their similarity to the largetooth sawfish implies that their reproductive biology may be similar. Genetic research currently underway may assist in determining reproductive characteristics (i.e., litter size and breeding periodicity). Research is also underway to investigate areas where adult smalltooth sawfish have been reported to congregate along the Everglades coast to determine if breeding is occurring in the area.

Life history information on the smalltooth sawfish has been evaluated using a demographic approach and life history data on largetooth sawfish and similar species from the literature. Simpfendorfer estimates intrinsic rates of natural population increase as 0.08 to 0.13 per year and population doubling times from 5.4 to 8.5 years (Simpfendorfer 2000). These low intrinsic rates of population increase are associated with the life history strategy known as “k-selection.” K-selected animals are usually successful at maintaining relatively small, persistent population sizes in relatively constant environments. Consequently, they are not able to respond effectively (rapidly) to additional and new sources of mortality resulting from changes in their environment. J.A. Musick (1999) noted that intrinsic rates of increase less than ten percent were low, and such species are particularly vulnerable to excessive mortalities and rapid population declines, after which recovery may take decades, (Musick, Harbin et al. 2000). Thus, smalltooth sawfish populations are expected to recover slowly from depletion. Simpfendorfer (2000) concluded that recovery was likely to take decades or longer, depending on how effectively sawfish could be protected. However, if ages at maturity for both sexes prove to be lower than those previously used in demographic assessments, then population growth rates are likely to be greater and recovery times shorter (Simpfendorfer et al. 2008).

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

Since the 1990s, the distribution of smalltooth sawfish in the United States has been restricted to peninsular Florida (Seitz and Poulakis 2002); (Poulakis and Seitz 2004); (Simpfendorfer and Wiley 2005); National Sawfish Encounter Database [NSED]). The Florida Museum of Natural History manages the NSED and is currently under contract with NMFS for smalltooth sawfish research. Encounter data indicates smalltooth sawfish encounters can be found with some regularity only in south Florida from Charlotte Harbor to Florida Bay. A limited number of reported encounters (one in Georgia, one in Alabama, one in Louisiana, and one in Texas) have occurred outside of Florida since 1998.

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

General Habitat Use Observations

Encounter databases have provided some general insight into the habitat use patterns of smalltooth sawfish. Poulakis and Seitz (2004) reported that where the substrate type of encounters was known 61 percent were mud, 11 percent sand, 10 percent seagrass, 7 percent limestone, 4 percent rock, 4 percent coral reef, and 2 percent sponge. Simpfendorfer and Wiley (2005a) reported closer associations between encounters and mangroves, seagrasses, and the shoreline than expected at random. Encounter data have also demonstrated that smaller smalltooth sawfish occur in shallower water, and larger sawfish occur regularly at depths greater than 32 feet (10 m). Poulakis and Seitz (2004) reported that almost all of the sawfish <10 feet (3 m) in length were found in water less than 32 feet (10 m) deep and 46 percent of encounters with sawfish >10 feet (3 m) in Florida Bay and the Florida Keys were reported to occur at depths between 200 to 400 feet (70 to 122 m). Simpfendorfer and Wiley (2005a) also reported a substantial number of larger sawfish in depths greater than 32 feet (10 m). Simpfendorfer and Wiley (2005a) demonstrated a statistically significant relationship between the estimated size of sawfish and depth, with smaller sawfish on average occurring in shallower waters than large sawfish. There are few verified depth encounters for adult smalltooth sawfish and more information is needed to verify the depth distribution for this size class of animals.

Encounter data has also identified river mouths as areas where many people observe sawfish. Seitz and Poulakis (2002) noted that many of the encounters occurred at or near river mouths in southwest Florida. Simpfendorfer and Wiley (2005a) reported a similar pattern of distribution along the entire west coast of Florida. Information on juvenile smalltooth sawfish indicates that they prefer shallow euryhaline habitats adjacent to red mangroves (NMFS 2009).

Juvenile habitat use

Very small juveniles < 39 in (100 cm) in length

Very small sawfish are those that are less than 39 in (100 cm), and are young-of-the-year. Like all elasmobranchs of this age, they are likely to experience relatively high levels of mortality due to factors such as predation (Heupel and Simpfendorfer 2002) and starvation (Lowe 2002). Many elasmobranchs utilize specific nursery areas that have lower numbers of predators and abundant food resources (Simpfendorfer and Milward 1993). Acoustic tracking results for very small smalltooth sawfish indicate that shallow depths and red mangrove root systems are likely important in helping them avoid predators (Simpfendorfer 2003). At this size smalltooth sawfish spend the vast majority of their time on shallow mud or sand banks that are less than 1 foot (30 cm) deep. Since water depth on these banks varies with the tide, the movement of the very small sawfish appears to be directed towards remaining in shallow water. It is hypothesized that by staying in these very shallow areas the sawfish are inaccessible to predators (mostly sharks) and increase their chances of survival. The dorso-ventrally compressed body shape helps them in inhabiting these shallow areas, and they can often be observed swimming in only a few inches of water.

The use of red mangrove prop root habitat is also likely to aid very small sawfish in avoiding predators. Simpfendorfer (2003) observed very small sawfish moving into prop root habitats when shallow habitats were less available (especially at high tide). One small animal tracked over three days moved into a small mangrove creek on high tides when the mud bank on which it spent low tide periods was inundated at depths greater than 1 foot (30 cm). While in this creek it moved into areas with high prop root density. The complexity of the prop root habitat likely restricts the access of predators and so protects the sawfish.

Very small sawfish show high levels of site fidelity, at least over periods of days and potentially for much longer. Acoustic tracking studies have shown that at this size sawfish will remain associated with the same mud bank over periods of several days. These banks are often very small and daily home range sizes can be of the magnitude of 100–1,000 m^2 (Simpfendorfer

2003). Acoustic monitoring studies have shown that juveniles have high levels of site fidelity for specific nursery areas for periods up to almost 3 months (Wiley and Simpfendorfer 2007b). The combination of tracking and monitoring techniques used expanded the range of information gathered by generating both short- and long-term data (Wiley and Simpfendorfer 2007b, NMFS SEFSC 2010) and further analysis of these data is currently underway.

Small juveniles 39–79 in (100–200 cm) in length

Small juveniles have many of the same habitat use characteristics seen in the very small sawfish. Their association with very shallow water (< 1 foot deep) is weaker, possibly because they are better suited to predator avoidance due to their larger size and greater experience. They do still have a preference for shallow water, remaining in depths mostly less than 3 feet (90 cm). They will, however, move into deeper areas at times. One small sawfish acoustically tracked in the Caloosahatchee River spent the majority of its time in the shallow waters near the riverbank, but for a period of a few hours it moved into water 4–6 feet deep (Simpfendorfer 2003). During this time, it was constantly swimming, a stark contrast to active periods in shallow water that lasted only a few minutes before resting on the bottom for long periods.

Site fidelity has been studied in more detail in small sawfish. Several sawfish approximately 59 in (150 cm) in length fitted with acoustic tags have been relocated in the same general areas over periods of several months, suggesting a high level of site fidelity (Simpfendorfer 2003). The daily home ranges of these animals are considerably larger (1–5 km^2) than for the very small sawfish and there is less overlap in home ranges between days. The recent implementation of acoustic monitoring systems to study the longer-term site fidelity of sawfish has confirmed these observations, and also identified that changes in environmental conditions (especially salinity) may be important in driving changes in local distribution and, therefore, habitat use patterns (Simpfendorfer et al 2011). Results from Simpfendorfer et al (2011), salinity electivity analysis indicate an affinity for salinities between 18 and at least 24 psu, suggesting movements are likely made in part, to remain within this range.

Nursery areas for juveniles ≤ 79 in or 200 cm in length

Using the Heupel et al. (2007) framework for defining nursery areas for sharks and related species such as sawfish, and juvenile smalltooth sawfish encounter data, NMFS identified two nursery areas (Charlotte Harbor Estuary Unit and Ten Thousand Islands/Everglades Unit) for juvenile smalltooth sawfish in south Florida. Heupel et al. (2007), argue that nursery areas are areas of increased productivity, which can be evidenced by natal homing or philopatry (use of habitats year after year), and that juveniles in such areas should show a high level of site fidelity (remain in the area for extended periods of time). Heupel et al. (2007) proposed that shark nursery areas can be defined based on three primary criteria: (1) juveniles are more common in the area than other areas, i.e., density in the area is greater than the mean density over all areas; (2) juveniles have a tendency to remain or return for extended periods (weeks or months), i.e., site fidelity is greater than the mean site fidelity for all areas; and (3) the area or habitat is repeatedly used across years whereas other areas are not. NMFS analyzed juvenile smalltooth sawfish encounter data and mapped the location of the areas that met the Heupel et al. (2007) criteria for defining a nursery area. Two nursery areas were identified as meeting these criteria and were included in a critical habitat designation in 2009 (74 FR 45353). The northern nursery area is located within the Charlotte Harbor Estuary and the southern nursery area is located in the

Ten Thousand Islands area south into the ENP. The essential features of the nursery areas are red mangroves and shallow euryhaline habitats with water depths less than 3 feet Mean Lower Low Water.

Large juveniles >79 in (200 cm) in length

There are few data on the habitat use patterns of large juvenile sawfish. No acoustic telemetry or acoustic monitoring studies have examined this size group. Thus there is no detailed tracking data to identify habitat use and preference. However, some data are available from the deployment of pop-up archival transmitting (PAT) tags. These tags record depth, temperature, and light data, which is stored on the tag until it detaches from the animal, floats to the surface, and sends data summaries back via the ARGOS satellite system. More detailed data can be obtained if the tag is recovered. A PAT tag deployed on a 79-in (200 cm) sawfish in the Marquesas Keys collected 120 days of data. The light data indicated that the animal had remained in the general vicinity of the outer Keys for this entire period. Depth data from the tag indicated that this animal remained in depths less than 17 feet (5 m) for the majority of this period, making only two excursions to water down to 50 feet (15 m) in depth. There is no information on site fidelity in this size class of sawfish. More data is needed from large juveniles before conclusions about their habitat use and preferences can be made.

Adult Habitat Use

Information on the habitat use of adult smalltooth sawfish comes from encounter data, observers onboard fishing vessels, and from PAT tags. The encounter data suggest that adult sawfish occur from shallow coastal waters to deeper shelf waters. Poulakis and Seitz (2004) observed that nearly half of the encounters with adult-sized sawfish in Florida Bay and the Florida Keys occurred in depths from 200 to 400 feet (70 to 122 m). Simpfendorfer and Wiley (2005a) also reported encounters in deeper water off the Florida Keys, noting that these were mostly reported during winter. Observations on commercial longline fishing vessels and fishery independent sampling in the Florida Straits report large sawfish in depths up to 130 feet (~40 meters) (NSED). Little information is available on the habitat use patterns of the adults from the encounter data.

PAT tags have been successfully deployed on several sawfish and have provided some data on movements and habitat use. One large mature female was fitted with a tag near East Cape Sable in November 2001. The tag detached from this animal 60 days later near the Marquesas Keys, a straight-line distance of 80 nautical miles (148 km). The data from this tag indicated that the fish most likely traveled across Florida Bay to the Florida Keys and then along the island chain until it reached the outer Keys. The depth data indicated that it spent most of its time at depths less than 30 feet (10 m), but that once it arrived in the outer Keys it made excursions (1–2 days) into water as deep as 180 feet (60 m).

Limited data are available on the site fidelity of adult sawfish. Seitz and Poulakis (2002) reported that one adult-sized animal with a broken rostrum was captured in the same location over a period of a month near Big Carlos Pass suggesting that they may have some level of site fidelity for relatively short periods. However, historic occurrence of seasonal migrations along the U.S. east coast also suggests that adults may be more nomadic than the juveniles with their distribution controlled, at least in part, by water temperatures.

Population Dynamics and Status

Despite being widely recognized as common throughout their historic range (Texas to North Carolina) up until the middle of the 20th century, the smalltooth sawfish population declined dramatically during the middle and later parts of the century. The decline in the population of smalltooth sawfish is attributed to fishing (both commercial and recreational), habitat modification, and sawfish life history. Large numbers of smalltooth sawfish were caught as bycatch in the early part of this century. Smalltooth sawfish were historically caught as bycatch in various fishing gears throughout their historic range, including gillnet, otter trawl, trammel net, seine, and to a lesser degree, handline. Frequent accounts in earlier literature document smalltooth sawfish being entangled in fishing nets from areas where smalltooth sawfish were once common but are now rare (Evermann and Bean 1897). There are few long-term abundance data sets that include smalltooth sawfish. One dataset from shrimp trawlers off Louisiana from the late 1940s through the 1970s suggests a rapid decline in the species from the period 1950-1964 (NMFS 2009). However, this dataset has not been validated nor subjected to statistical analysis to correct for factors unrelated to abundance.

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

There is currently no estimate of smalltooth sawfish abundance throughout its range. Although smalltooth sawfish encounter databases may provide a useful future means of measuring changes in the population and its distribution over time, including the current range, areas where recovery may be expected to occur, and the habitat needs of various size classes. Conclusions about the current abundance of smalltooth sawfish cannot be made because outreach efforts and observation effort have not expanded evenly across each study period (Wiley 2010). However, based on genetic sampling, the estimates of current effective population size are 269.6 – 504.9 individuals (95% Confidence Interval 139.3 – 1515). (E-mail communication between Demian Chapman and Tonya Wiley, April 11, 2010). Chapman also states that this number is usually ½ - ¼ census population size (breeding adults, male and female) in elasmobranchs, so it appears high hundreds to low thousands is probably the estimated range expected for the extant breeders

Threats

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

Recreational and commercial fisheries also still pose a threat to smalltooth sawfish. Although changes over the past decade to U.S. fishing regulations such as Florida's "Net Ban", which includes both a prohibition on the use of gill and entangling nets in all state waters and a size limit on other nets such as seines, have reduced these threats to the species over parts of its range; however, smalltooth sawfish are still incidentally caught in commercial shrimp trawls, bottom longlines, and by recreational rod-and-reel fisheries.

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

4.0 Environmental Baseline

The environmental baseline describes the status of the species within the action area, provides the results of any surveys that may have been done in the action area, and describes the factors affecting the species within the action area. The distribution of sea turtle nesting activity on Florida's Gulf coast (Manatee, Sarasota, Charlotte, Lee, and Collier Counties) makes up a small percentage of the overall nesting activity within the state when compared to the east coast epicenter of sea turtle nesting located between Brevard and Palm Beach Counties. According to the FWC statewide nesting database, 9 percent of the total 2009 nesting activity on Florida's coastline occurred on the Gulf coast. During the 2009 nesting season, Sarasota County and Manatee County, combined, accounted for approximately 4 percent of the overall sea turtle nesting in the state of Florida (FWRI 2010a). Although green, Kemp's ridley, hawksbill, and leatherback sea turtles have been documented as nesting on Florida's Gulf coast beaches, the loggerhead sea turtle is by far the dominant nesting species. Sea turtle monitoring for Longboat Key is conducted by Mote Marine Lab (MML) Sea Turtle Conservation and Research Program (STCRP) personnel, interns, and volunteers authorized under FWC Marine Turtle Permits #054 and #027 issued to Ms. Paula Clark.

Green Sea Turtles
Since 1994, 101 green sea turtle nests have been deposited in Sarasota County; 11 were deposited in 2009 and 7 in 2008. Mote Marine Lab reported a total of 5 green sea turtle nests observed on Longboat Key since 2001; one in 2003, one in 2004, two in 2007, and one in 2008 (Tucker et al. 2009).

Hawksbill Sea Turtles
One hawksbill sea turtle nest was documented on Longboat Key by FWC staff in 1979. This nest was verified at the time by phone descriptions; however, no specimens were taken for further verification. Because hawksbills are typically tropical nesters, MML questions the validation of this single hawksbill nest (CP&E BA 2010). Within the continental United States, hawksbill nesting is restricted to and rare in the southeast coast of Florida and the Florida Keys (NMFS 2010). Florida is not considered one of the nesting concentrations for hawksbill sea turtles (NMFS and USFWS 2007a).

Kemp's Ridley Sea Turtles
In 2009, two nests were observed on Casey Key and one on Venice in Sarasota County and one nest was documented on Sanibel Island in Lee County. In Sarasota County, these were the first recordings of a Kemp's ridley nest since 1999. According to data collected by MML, no Kemp's ridley sea turtle nests have ever been observed on Longboat Key beaches (CP&E BA 2010). As for swimming sea turtles, Davis et al. (2000) reported three Kemp's ridleys in open waters along the continental shelf in the northern Gulf of Mexico based on aerial and boat surveys. The observations noted here are not near the borrow areas or the fill areas of the proposed project on Longboat Key.

Loggerhead Sea Turtles
Loggerhead turtles account for the majority of nests observed on Longboat Key. Table 4.1 presents Longboat Key loggerhead sea turtle nesting data collected by MML between 2002 and 2009 (Tucker et al. 2009), including the total number of loggerhead nests and the percentage of the total nesting activity on Longboat Key that were loggerhead nests; green sea turtles are the only other documented species to nest on Longboat Key during this time frame.

Table 4.1. Loggerhead sea turtle nests observed on Longboat Key from 2002-2009 and the percentage Loggerhead nests account for of all sea turtle nests observed.

Year	No. of Nests	Percent of Total Nesting activity
2002	213	100
2003	293	99.7
2004	161	99.4
2005	151	100
2006	160	100
2007	143	98.6
2008	252	99.6
2009	216	100

Leatherback Sea Turtles
With the exception of a few nests on the west coast, leatherback nesting occurs primarily on the east coast of Florida - almost 50 percent of all nests in Florida occur in Palm Beach County (FWRI2010a). The first leatherback nesting event documented along the central west coast shoreline of Florida occurred on May 31, 2001, on Longboat Key in Sarasota County (Tucker, pers. comm. 2010); one nest was also deposited on Sanibel Island in Lee County in 2009 (Tucker et al. 2009).

Smalltooth Sawfish
While the center of distribution and the designated critical habitat for the species are located approximately 40 miles to the south of the action area, the species may be affected by project activities. While no smalltooth sawfish interactions are known to have occurred from hopper dredging, a smalltooth sawfish was captured in August 2006 in a relocation trawl just north of this project during the Egmont Key channel dredging project. Thus, smalltooth sawfish may potentially be captured during relocation trawling activities associated with hopper dredging.

4.2 Other Factors Affecting Sea Turtles in the Action Area

The activities that shape the environmental baseline in the action area of this consultation are primarily federal fisheries. Other environmental impacts include effects of vessel operations, military activities, dredging, oil and gas exploration, permits allowing take under the ESA, private vessel traffic, and marine pollution.

4.2.1 Federal Actions

NMFS has undertaken a number of Section 7 consultations to address the effects of federally-permitted fisheries and other federal actions on threatened and endangered sea turtle species, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to minimize the adverse impacts of the action on sea turtles through changes to the action as proposed or through reasonable and prudent measures. The summary below includes only those federal actions in the action area that have already concluded or are currently undergoing formal Section 7 consultation.

4.2.1.1 Fisheries

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

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

Gulf shrimp trawl fisheries
Shrimp trawling has had the greatest adverse effect on sea turtles in the Gulf of Mexico. As sea turtles rest, forage, or swim on or near the bottom, they are captured by shrimp trawls pulled along the bottom. Shrimp trawling increased dramatically in the Gulf between the 1940s and the 1960s. By the late 1970s, there was evidence thousands of sea turtles were being killed annually

in the Southeast (Henwood and Stunz 1987). In 1990, the NRC concluded the Southeast shrimp trawl fishery affected more sea turtles than all other activities combined and was the most significant anthropogenic source of sea turtle mortality in U.S. waters, in part due to the high reproductive value of the large, mature turtles taken in this fishery (NRC 1990).

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

Despite the success of TEDs for some species of sea turtles, it was later discovered that TEDs were not adequately protecting all species and size classes of sea turtles. Analyses by Epperly and Teas (2002) indicated that the minimum requirements for the escape opening dimension in TEDs in use at that time were too small and that as many as 47 percent of the loggerheads stranding annually along the Atlantic and Gulf of Mexico were too large to fit the existing openings.

On December 2, 2002, NMFS completed the most recent opinion for shrimp trawling in the southeastern U.S. (NMFS 2002b) under proposed revisions to the TED regulations (68 FR 8456, February 21, 2003). This opinion determined that the shrimp trawl fishery under the revised TED regulations would not jeopardize the continued existence of any sea turtle species. This determination was based, in part, on the opinion’s analysis that showed the revised TED regulations were expected to reduce shrimp trawl related mortality by 94 percent for loggerheads and 97 percent for leatherbacks.

The 2002 shrimp opinion take estimates are based in part on 2001 fishery effort levels. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of recent hurricanes in the Gulf of Mexico have all impacted the shrimp fleets; in some cases reducing fishing effort by as much as 50 percent for offshore waters of the Gulf of Mexico (GMFMC 2007).

On August 16, 2010, NMFS reinitiated Section 7 consultation on the continued implementation of the sea turtle conservation regulations affecting the shrimp trawl fisheries in state and federal waters of the Southeast U.S and its effects on sea turtles. The reinitiation was primarily based on elevated strandings in the northern Gulf of Mexico during the spring of 2010 (that were observed again in the spring of 2011), necropsy information indicating that drowning may have contributed to many of the mortalities, and evidence of fisher compliance with Turtle Excluder Device (TED) requirements that was much lower than assumed, collectively indicating sea turtles may be affected by shrimp trawling to an extent not previously considered in the December 2, 2002, biological opinion. As part of the ongoing reinitiated consultation, NMFS is updating its 2002 estimates of the numbers of sea turtle interactions and mortalities (bycatch) in Southeast shrimp fisheries based on the best available new information. The new estimates will consider: (1) declines in shrimp fishing effort in the Southeast, (2) increases in the population sizes of Kemp's ridley and green sea turtles, and (3) information on shrimp industry compliance with TED regulations. The new shrimp bycatch estimates will also incorporate bycatch from all gear types, including skimmer trawls, which account for a large fraction of the shrimp fishing effort in the Gulf of Mexico, and try nets. These other gear types were previously considered for their effects on sea turtles, but only qualitatively.

U.S. Gulf shrimp fisheries target primarily brown, white, and pink shrimp in inland waters and estuaries through the state-regulated territorial seas and into federal waters of the EEZ. Brown shrimp are the most important species in the Gulf fishery, with catches high along the Texas, Louisiana, and Mississippi coast. They are caught out to at least 50 fathoms, but most come from waters less than 30 fathoms. White shrimp, second in value, generally range along the Gulf coast from the mouth of the Ochlockonee River in Florida, to Campeche, Mexico, in nearshore waters to 20 fathoms, with most of the catch coming from less than 15 fathoms. Pink shrimp are most abundant off Florida's west coast and particularly in the Tortugas off the Florida Keys. Thus, while a small amount of shrimp effort likely does occur within the action area, most shrimp fishing and its associated historic and current sea turtle bycatch occurs outside of the action area in other areas of the Gulf.

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

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

NMFS most recently reinitiated consultation in 2004 on this fishery as a result of exceeded incidental take levels for loggerheads and leatherbacks (NMFS 2004b). The resulting opinion (NMFS 2004b) stated the long-term continued operation of this 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. The 2004B opinion evaluated a rule implementing management measures to reduce bycatch and bycatch mortality of Atlantic sea turtles in the Atlantic pelagic longline fishery (69 FR 40734, July 6, 2004). The management measures include mandatory circle hook and bait requirements, and mandatory possession and use of sea turtle release equipment to reduce bycatch mortality. The 2004B opinion's reasonable and prudent alternatives and reasonable and prudent measures were designed to ensure the predicted significant benefits in mortality reduction to endangered and threatened sea turtles actually occur.

Atlantic HMS Directed Shark Fisheries

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

Growing demand for shark and shark products encouraged expansion of the commercial shark fishery through the 1970s and 1980s. As catches accelerated through the 1980s, shark stocks started to show signs of decline. Peak commercial landings of large coastal and pelagic sharks were reported in 1989. Atlantic sharks have been managed by NMFS since the 1993 FMP for Atlantic Sharks. At that time, NMFS identified LCS as overfished and implemented commercial quotas for LCS (2,436 mt dressed weight [dw]) and established recreational harvest limits for all sharks. In 1994, under the rebuilding plan implemented in the 1993 Shark FMP, the LCS quota was increased to 2,570 mt dw; in 1997, NMFS reduced the LCS commercial quota by 50 percent to 1,285 mt dw and the recreational retention limit to two LCS, SCS, and pelagic sharks combined per trip with an additional allowance of two Atlantic sharpnose sharks per person per trip (62 FR 16648, April 2, 1997). Since 1997, the directed LCS fishing season has generally been open for the first three months of the year and then a few weeks in July/August.

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

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

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

4.2.1.2 Vessel Operations and Military Activities

Potential sources of adverse effects from federal vessel operations in the action area include operations of the U.S. Department of Defense (DOD), USN, Air Force (USAF), USCG, Environmental Protection Agency (EPA), NOAA, and COE. NMFS has also conducted Section 7 consultations on vessel traffic related to energy projects in the Gulf of Mexico (MMS, FERC, and MARAD) to implement conservation measures. The USCG has recently engaged NMFS in consultation on these actions to determine the magnitude of the adverse impacts resulting from these events in nearshore waters. Consultations on individual activities have been completed (e.g., NMFS 1995b, NMFS 1997), and a formal consultation on overall USN activities on the East coast has been completed (NMFS 2011). However, no overall consultation on USN or USCG efforts in the Gulf of Mexico has been completed at this time. Refer to the opinion for the USCG (NMFS 1995b) for details on the scope of vessel operations for these agencies and conservation measures being implemented as standard operating procedures.

4.2.1.3 ESA Permits

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

4.2.2 State or Private Actions

4.2.2.1 Vessel Traffic

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

4.2.3 Other Potential Sources of Impacts in the Environmental Baseline

4.2.3.1 Marine Debris and Acoustic Impacts

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

4.2.3.2 Marine Pollution and Environmental Contamination

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

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

There are studies on organic contaminants and trace metal accumulation in green and leatherback sea turtles (Aguirre et al. 1994; Caurant et al. 1999; Corsolini et al. 2000). Mckenzie *et al.* (1999) measured concentrations of chlorobiphenyls and organochlorine pesticides in sea turtles tissues collected from the Mediterranean (Cyprus, Greece) and European Atlantic waters (Scotland) between 1994 and 1996. Omnivorous loggerhead turtles had the highest organochlorine contaminant concentrations in all the tissues sampled, including those from green and leatherback turtles (Storelli et al. 2008). It is thought that dietary preferences were likely to be the main differentiating factor among species. Decreasing lipid contaminant burdens with turtle size were observed in green turtles, most likely attributable to a change in diet with age. Sakai et al (1995) found the presence of metal residues occurring in loggerhead turtle organs and eggs. Storelli et al (1998) analyzed tissues from twelve loggerhead sea turtles stranded along the Adriatic Sea (Italy) and found that characteristically, mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals and porpoises (Law et al. 1991). No information on detrimental threshold concentrations is available, and little is known about the consequences of exposure of organochlorine compounds to sea turtles. Research is needed on the short- and long-term health and fecundity effects of chlorobiphenyl, organochlorine, and heavy metal accumulation in sea turtles.

Nutrient loading from land-based sources, such as coastal communities and agricultural operations, are known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. An example is the large area of the Louisiana continental shelf with seasonally-depleted oxygen levels (< 2 mg/Liter) is caused by eutrophication from both point and non-point sources. Most aquatic species cannot survive at such low oxygen levels and these areas are known as “dead zones.” The oxygen depletion, referred to as hypoxia, begins in late spring, reaches a maximum in mid-summer, and disappears in the fall. Since 1993, the average extent of mid-summer, bottom-water hypoxia in the northern Gulf of Mexico has been approximately 16,000 km^2, approximately twice the average size measured between 1985 and 1992. The hypoxic zone attained a maximum measured extent in 2002, when it was about 22,000 km^2 which is larger than the state of Massachusetts (U.S.

Geological Service 2005). The hypoxic zone has impacts on the animals found there, including sea turtles, and the ecosystem-level impacts continue to be investigated.

4.2.4 Conservation and Recovery Actions Benefiting Sea Turtles

We have implemented a series of regulations aimed at reducing the potential for incidental capture and mortality of sea turtles from commercial fisheries in the action area. These include sea turtle release and gear requirements for Atlantic HMS, Gulf of Mexico reef fish, and shrimp TED requirements.

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

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

Sea Turtle Handling and Resuscitation Techniques
We have issued regulations (66 FR 67495, December 31, 2001) detailing handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the final rule. These measures help to prevent mortality of hard-shelled turtles caught in fishing or scientific research gear. There is an extensive network of Sea Turtle Stranding and Salvage Network participants along the Atlantic and Gulf of Mexico coasts who not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded sea turtles.

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

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

Other Actions
A revised recovery plan for the loggerhead sea turtle was completed December 8, 2008 (NMFS and USFWS 2008). The recovery plan for the Kemp's ridley sea turtle was completed September 22, 2011 (NMFS et al 2011). 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). As described in the Status of the Species section above, loggerhead sea turtles are now identified as DPS's. The final rule was published on September 22, 2011, and took effect on October 24, 2011.

4.2.5 Summary and Synthesis of Environmental Baseline for Sea Turtles

In summary, several factors adversely affect sea turtles in the action area. These factors are ongoing and are expected to occur contemporaneously with the proposed action. Fisheries in the action area likely had the greatest adverse impacts on sea turtles in the mid to late 1980s, when effort in most fisheries was near or at peak levels. With the decline of the health of managed fish stocks, fishing effort has generally been declining. Over the past five years, the impacts associated with fisheries have also been reduced through the Section 7 consultation process and regulations implementing effective bycatch reduction strategies. However, interactions with commercial and recreational fishing gear are ongoing and are expected to occur contemporaneously with the proposed action. Other environmental impacts including effects of vessel operations, additional military activities, dredging, oil and gas exploration, permits allowing take under the ESA, private vessel traffic, and marine pollution have also had and continue to have adverse effects on sea turtles in the action area. The recent DWH oil release event is expected to have had an adverse impact on the status of sea turtles, but the extent of that impact is not yet well understood.

4.3 Smalltooth Sawfish within the Action Area

Smalltooth sawfish are not highly migratory species, although some large mature individuals may engage in seasonal north/south movement. The core range of the U.S. DPS of smalltooth sawfish is currently in south and southwest Florida. The action area comprises a very small portion of this range and may be the current northern extent.

4.3.1 Federal Actions

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

4.3.1.1 Fisheries

Several federal fisheries in the Gulf are believed to adversely affect smalltooth sawfish, including the Gulf shrimp trawl, coastal migratory pelagic resources, spiny lobster fisheries, and Gulf HMS shark fisheries. Gulf HMS shark fisheries include commercial shark bottom longline and drift gillnet fisheries and recreational shark fisheries under the FMP for Atlantic Tunas, Swordfish, and Sharks (HMS FMP). NMFS has consulted formally twice on effects of HMS shark fisheries on smalltooth sawfish (i.e., NMFS 2003a and NMFS 2008). Both bottom longline and gillnet gear are known to adversely affect smalltooth sawfish. The observer program for sharks covered approximately 598,384 hooks or 1.6 percent of all hooks in the bottom longline fleet between 1994 and 2002. Over that time, eight smalltooth sawfish were observed caught and of these, none were within the action area. Since then, four additional smalltooth sawfish have been caught on shark bottom longlines, but they have all been in the Atlantic. Only one smalltooth sawfish has been observed incidentally caught in the shark drift gillnet fishery and this capture occurred in the Atlantic, where the shark drift gillnet fishery predominantly operates.

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

The other fisheries have been consulted on separately and were determined to not be likely to jeopardize the continued existence of smalltooth sawfish (NMFS 2006b, NMFS 2007a, NMFS 2009d). An ITS was provided for each fishery. The Gulf Shrimp trawl fishery is anticipated to result in up to one take annually, anticipated being lethal. NMFS has reinitiated consultation for the shrimp trawl fishery and will analyze any new information to determine if the anticipated interaction level has changed. The coastal migratory pelagic resources fishery is anticipated to result in two non-lethal smalltooth sawfish entanglements in gillnet gear annually. The Gulf spiny lobster fishery is anticipated to result in only two non-lethal smalltooth sawfish interactions every three years via entanglement in trap lines.

4.3.1.2 ESA Permits

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

4.3.2 State or Private Actions

Fisheries

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

4.3.3 Other Potential Sources of Impacts in the Environmental Baseline

Marine Pollution

Marine pollution, including litter and discarded fishing gear, also pose potential problems for sawfish. Smalltooth sawfish have been encountered with polyvinyl pipes and fishing gear on their rostrum (Gregg Poulakis, pers. comm. 2007). The same sources of pollutants described in Section 4.2.3.2 may also adversely affect smalltooth sawfish.

4.3.4 Conservation and Recovery Actions Shaping the Environmental Baseline

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

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

Public outreach efforts are also helping to educate the public on smalltooth sawfish status and proper handling techniques and helping to minimize interaction, injury, and mortality of encountered smalltooth sawfish. Information regarding the status of smalltooth sawfish and what the public can do to help the species is available on the Web site of the FLMNH,[4] NMFS,[5]

[4] http://www.flmnh.ufl.edu/fish/Sharks/Sawfish/SRT/srt.htm

and the Ocean Conservancy.[6] Reliable information is also available at websites maintained by noted sawfish expert Matthew McDavitt.[7] These organizations and individuals also educate the public about sawfish status and conservation through regular presentations at various public meetings.

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

4.3.5 Summary of Environmental Baseline for Smalltooth Sawfish

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

5.0 Effects of the Action

Effects of the action include the direct and indirect effects of an action on the species, together with the effects of other activities that are interrelated or interdependent with the action. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

Direct and indirect effects of the proposed action will be attributable to dredging, movement of the dredge, sand deposition on Longboat Key, and relocation trawling, and will be discussed below. The full scope of effects of the project results from BOEM's proposed action and all activities that are interdependent and interrelated to the proposed action. Therefore, effects must be evaluated from dredging of sand from sources located in state and federal waters, and precautionary sea turtle relocation trawling in federal and state waters, and sand deposition on Longboat Key. These actions are analyzed individually and additively in the following paragraphs.

---

[5] http://www.sero.nmfs.noaa.gov/pr/SmalltoothSawfish.htm
[6] http://www.oceanconservancy.org/site/PageServer?pagename=fw_sawfish
[7] http://hometown.aol.com/nokogiri/

Amount and Duration of Hopper Dredging in Federal Waters
Dredging in federal waters will occur preferentially before dredging in state waters because the Dolphin Pipeline LNG project will start in 2013, and will eliminate access to BAF2 in federal waters. Thus, portions of this sand source will not be utilizable after 2013. A medium-sized hopper dredge will excavate sand from BAF2 and transport it to the seaward end of the submerged pipeline for pumping to fill areas. Dredging activities in BAF2 are expected to remove up to 239,500 cy in the initial phase of the project (FY 11/12) and may remove up to an additional 227,000 cy over the duration of the project (FY 13/14); however, at this time, it is anticipated that only 100,000 cy will be removed for the FY 13/14 portion of the project. It is anticipated that the medium-sized hopper dredge will move approximately 10,000 cy of sand per day, resulting in up to four round-trips from the borrow area to the pipeline per day. Using these estimates, we can assume dredging in BAF2 will last approximately 34 days (339,500 cy of sand/10,000 cy per day). However, because an additional 227,000 cy may be removed from BAF2 in FY 13/14, we will use the more conservative estimate of dredging occurring for 47 days in BAF2 (239,500 cy/10,000 cy per day in FY 11/12 + 227,000 cy of sand/10,000 cy per day in FY 13/14).

Amount and Duration of Hopper Dredging in State Waters
The hopper dredge may alternately excavate sand from borrow areas BA3, BAIX, and BAX, and transport it to the seaward end of the submerged pipeline for pumping to fill areas; i.e., alternating its dredging cycles from federal to state waters and vice versa, based on sand quality and nourishment needs. Using current projections, dredging activities in BA3, BAIX, and BAX will remove a total of up 635,000 cy of material. It is anticipated that the medium-sized hopper dredge will move approximately 10,000 cy of sand per day, resulting in up to four round-trips from the borrow areas to the pipeline per day. Using these estimates, we can assume dredging in BA3, BAIX, and BAX will last approximately 64 days (635,000 cy of sand/10,000 cy per day).

Sand Placement in State Waters
The Town's permit application to the COE included a request to dredge sand from BAIX and BAX with temporary placement within two rehandling areas. While this methodology is not certain to be implemented by the dredging contractor, it is an option within the scope of the project. Rehandling would involve discharging through a pipe or bottom-dumping sand into deeper water areas so that it can be more efficiently transported via a medium-size hopper dredge to Longboat Key. If rehandling related to dredging in BAIX and BAX occurs, additional dredging days will occur from the rehandling site. This could involve the rehandling of up to 565,000 cy of material. Using the estimates for hopper dredge material movement (10,000 cy/day) and the rehandling material volume, an additional 57 days of dredging in state waters may occur.

Although there are nearshore hardgrounds that might serve as foraging habitat and attract sea turtles to the area and that could be impacted by placing sand on the beach or discharging sand into rehandling areas, the contractor is required to avoid all hardground areas for the duration of the project. All vessel operators will be provided with maps and GPS coordinates of the location of hardbottom areas. Electronic navigations systems aboard the dredge vessel should enable it to easily avoid hardbottom areas. During dredging activities vessel operators will maintain a 400-ft (minimum) buffer from the hardbottom areas. Thus, no impacts to these nearshore hardgrounds are expected, nor were any recorded during similar sand placement operations, with similar precautions in place, in 2005-2006.

Summary of Anticipated Dredging Days and Volumes over the Project Duration
We conservatively anticipates that dredging in state and federal waters combined will take approximately 168 days over the 10-year life of the project (47 days for BAF2 + 64 days for BA3, BAIX, and BAX, + 57 days for potential re-handling).

Dredging for the Longboat Key beach nourishment project is expected to remove approximately 975,000 cubic yards from submerged lands adjacent to Longboat Key and Anna Maria Island. While it is estimated that up to 5,783,000 cy of material is available within state waters and 446,500 cy of material is available from federal waters, not all of this potential volume is needed for the current project. The exact volumes to be used from borrow areas are not known at this time, as the Town would like to maintain flexibility to maximize the use of BAF2 prior to the construction of the Port Dolphin pipeline (once the pipeline is in operation, BAF2 will not be able to be used for sand extractions) and minimize project costs by providing a suite of options to dredge contractors. At this time, approximately 339,500 cy of material is projected to be removed from federal waters and up to 635,000 cy of material is projected to be removed from state waters. However, up to 466,500 cy of material could be removed from BAF2.

Vessel Traffic Effects
We believe that the possibility that the hopper dredges will collide with and injure or kill sea turtles or smalltooth sawfish during dredging and/or sand pumpout operations is discountable, given the vessels' slow speed, the mobility of these species, anticipated avoidance behavior by sea turtles, and the benthic habitats of smalltooth sawfish.

Hopper Dredge Observers
NMFS-approved protected species observers monitor dredged material inflow and overflow screening baskets on many hopper dredging projects, and observers will be required as well on this project to monitor the proposed action. During the proposed dredging operations, protected species observers (2) will live aboard the dredges, monitoring every load, 24 hours a day, for evidence of dredge related impacts to protected species, particularly sea turtles. Additionally, rigid turtle deflectors will be installed on the dragheads before work begins and all points of dredged material inflow into the hopper will be screened. Cages will be attached to the ends of discharge pipes into the hopper, be constructed of steel bar-stock, and welded in a grid pattern with openings approximately 4-in x 4-in. Observers will clean and inspect these screens, 24-hours a day, to document any evidence of sea turtle interactions. Observers will also maintain a bridge watch for protected species and keep a logbook noting the date, time, location, species, number of animals, distance and bearing from dredge, direction of travel, and other information, for all sightings. During all phases of dredging operations, the dredge and crew will be required to adhere to NMFS' *Sea Turtle and Smalltooth Sawfish Construction Conditions*.

NMFS Estimates of Unobserved Interactions
Dredged material screening, however, is only partially effective, and observed interactions likely provide only partial estimates of total sea turtle mortality. We believe that some turtles killed by hopper dredges 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 interactions may go unnoticed. The only mortalities that are noticed and documented are those where body parts float, are large enough to be caught in the screens, and can be identified as sea turtle parts. Body parts that are forced through the 4-inch (or greater) inflow screens by the suction-pump pressure and that do not float are very unlikely to be observed, since they will sink to the bottom of the hopper and not be detected by the overflow screening. Unobserved interactions are not documented, thus, observed interactions may under-represent actual lethal interactions. It is not known how many turtles are killed but unobserved. Because of this, in the GRBO (NMFS 2003b), in our jeopardy analysis, we estimated that up to one out of two impacted turtles may go undetected (i.e., that observed interactions constitute only about 50 percent of total interactions), an estimate which we will use in the present opinion, since we have no new information that would change the basis of that previous conclusion and estimate.

Estimated Sea Turtle Interactions from the Proposed Dredging
Based on STSSN data (Figure 5.0.1 and 5.0.2), historical distribution data, hopper dredge observer reports, and relocation trawling information, green, hawksbill, Kemp's ridley, loggerhead, and leatherback sea turtles may occur in the action area and may be taken by the relocation trawling or hopper dredging operations of this project.

Our estimates of sea turtle interactions with hopper dredges during the proposed action are largely based on interactions occurring during past hopper dredging projects at the same approximate location. The Town undertook a beach renourishment project in 2005-2006. During this project, approximately 346 "dredge days" were logged, completing 1,353 loads. Two sea turtles (one loggerhead and one green) were observed and documented by onboard protected species observers as killed during dredging activities. The observer's main job is to sort through screened boxes that the dredged material passes through on its way into the hopper, looking for evidence of sea turtle entrainment (i.e., turtle body parts). The first sea turtle was killed on November 5, 2005, three days prior to the implementation of relocation trawling (discussed below); the other was observed and documented by onboard protected species observers as killed on January 25, 2006. Dredged material screening, however, is only partially effective, and observed interactions likely do not represent total sea turtle mortality. Thus, during 2005-2006 dredging, we estimated that a total of four sea turtles may have been killed: two documented and two unobserved. During that dredging, 129 turtles were relocated. From March 23 to June 20, 2011, approximately 89 dredging days, the north end of Longboat Key was renourished by hopper dredge, using sand dredged from a nearshore borrow area in state waters. Hopper dredging during this activity resulted in zero documented turtle interactions, though 25 sea turtles were relocated by capture trawlers.

During 2005-2006 dredging, approximately 2,122,299 cubic yards of material were moved from state waters. This results in an estimated sea turtle lethal interaction rate of 0.0000018 turtle per cubic yard dredged (4 turtles per 2,122,299 cubic yards). For the present project, approximately 635,000 cubic yards of material are projected to be hopper dredged from state waters, yielding a total estimate of lethal interactions of 1.14 turtles. Additionally, approximately 565,000 cy of material may be re-handled in state waters, yielding a total estimate of lethal interaction of 1.017 turtles. These interactions are covered by the GRBO, since the COE is anticipated to issue a regulatory permit for the portion of dredging during this project that occurs in state waters. The COE retains the authority to modify their regulatory permit conditions at any time and rescind the permit, if need be.

Applying to federal waters the same estimated turtle lethal interaction rate of 0.0000018 turtle per cubic yard dredged that was applied to state waters, we anticipate, based on a maximum of 466,500 cubic yards of material that could be dredged under BOEM permitting authority, that 0.84 turtle may be killed by dredging in federal waters during this project. Thus, an estimated total of three turtles (1.017 + 1.14+ 0.84 = 2.997, rounded to 3) may be killed (includes observed and unobserved) during hopper dredging of 975,000 cy in state and federal waters for this project.

Based on the aforementioned GRBO estimate of 50 percent detection rate by NMFS-approved, shipboard protected species observers, it is likely that only one or two of these three total turtle takes will be observed and documented by onboard observers in state and federal waters. Howerver, we cannot reliably predict whether the projected turtle interactions will take place in federal or state waters; individual hopper dredge loads may be comingled with sand from both sources, making it impossible to determine where a take occurred. Sometimes, matching turtle parts are recovered days after the initial mortality, in subsequent loads, moved by currents to different areas. Given this uncertainly and the need to avoid underestimating the amount of take that may occur in federal waters, we will assume that up to two *observed* and one unobserved lethal sea turtle interactions may occur in federal waters under BOEM's jurisdiction as a result of hopper dredge suction draghead entrainment during this project. We estimate that the interactions occurring under actions authorized by BOEM will be with green and/or loggerhead sea turtles, because these are the most common in the action area, the most abundant species in the STSSN data, and the only species interacted with during the 2005-2006 project. We estimate that the two observed incidental, lethal interactions in federal waters will consist of one green and one loggerhead during the estimated 47 days of dredging in federal waters over the project's 10-year time frame.

Previous Longboat Key Relocation Trawling as a Basis for Estimating Future Relocation Trawling Interactions

The Town undertook a beach renourishment project in 2005-2006. During the final eight months of this project, relocation trawling was conducted on more than 200 days. During that time, 129 sea turtles were relocated from dredging areas, including 74 loggerheads, 41 Kemp's ridleys, 12 greens, and 2 hawksbills, for a turtle capture rate of 0.645 turtle per trawl day. Only two loggerheads were captured and sent for rehabilitation during this time; one with propeller cuts not thought to be associated with trawling activities, the other severely emaciated. Additionally, only two recaptures occurred, suggesting relocation trawling is highly efficient at limiting impacts to sea turtles. During the Longboat Key dredging project from March 23-June 20, 2011, authorized by the COE under regulatory permit SAJ-2010-1056, a total of 25 turtles were captured and relocated, with one recapture and one turtle sent for rehabilitation, for a turtle capture rate of 0.281 turtle per trawl day; no turtles were captured at the borrow site.

As discussed previously, dredging operations are projected to last 47 days in BAF2 to remove up to 466,500 cubic yards and 64 days in combined borrow areas BA3, BAIX, and BAX to remove the remaining maximum of 635,500 cubic yards of materials. However, up to 466,500 cy of material could be removed from BAF2 if the other borrow areas are not used, which would occur over a total of 47 days. Based on these estimates, the data from the 2005-2006 project, STSSN data from 2008-2010, and data from the 2011 project, we can estimate the number of turtles to be captured during relocation trawling activities in association with the dredging activities in BA F2 (in federal waters) and BA3, BAIX, and BAX (in state waters).

Estimated Sea Turtle Captures and Mortality by Relocation Trawling
We have previously estimated that the proposed action will require 168 days of dredging in state and federal waters combined. Since relocation trawling will occur simultaneously with dredging, we will assume 168 days of relocation trawling. We will use the sea turtle capture rate achieved during the 200 days of relocation trawling in 2005-2006 to estimate numbers of captures during the proposed action. To be conservative in our estimate of the number of turtle captures that may occur during the proposed action in both state and federal waters, we purposely chose the highest trawl capture rate from previous Longboat Key dredging/turtle relocation projects in making capture estimates. Thus, based on 200 days of relocation trawling which resulted in 129 turtle captures in 2005-2006 and a per trawl-day capture rate of 0.645 turtle, during the proposed action we estimate that relocation trawling in state and federal waters combined may result in 108.36 (109) trawl captures in 168 days (i.e., 129/200 x 168).

We also estimate that, based on STSSN species percent strandings composition data presented in Figure 5.0.2, and accounting for rounding errors, the 109 trawl captures in state and federal waters will consist of 49 loggerheads, 44 greens, 11 Kemp's ridleys, 4 hawksbills, and 1 leatherback during the 168 days of the project over the 10-year time frame.

To estimate the location (i.e., state or federal waters) of these estimated 109 trawl captured turtles, we multiplied the trawl-day capture rate (0.645) by the days in federal waters (47) versus the days in state waters (121). We estimate that, of these 109 trawl captures, there will be 0.645 x 47 = 30.3 (31) from federal waters and 0.645 x 121 = 78.045 (78) from state waters.

To estimate the species distribution of turtles captured in federal waters, we used the percent stranding data by species from SSTSN Table 5.0.1 and determined that the 31turtles taken in federal waters will consist of 14 loggerheads, 12 greens, 3 Kemp's ridleys, 1 hawksbill, and 1 leatherback.

Similarly, we estimate using the percentage species composition data from STSSN presented in Table 5.0.1 that sea turtle species composition of the 78 turtles anticipated to be captured in state waters will consist of 35 loggerheads, 31 greens, 8 Kemp's ridleys, 3 hawksbills, and 1 leatherback. As previously discussed, any trawler takes of turtles in state waters are already anticipated and authorized by, and counted against the ITS of, the GRBO.

The relocation trawling may result in sea turtle capture, but this type of interaction is not expected to be injurious or lethal due to the short duration of the tow times (less than 42 minutes per tow) and required safe-handling procedures. We cannot rule out that injury or mortality could occur, but such events are rare. Based on a conservative 0.5 percent estimate of trawl-related sea turtle mortality (as previously discussed in *Total Impact of Relocation Trawling on*

Sea Turtles section), we estimate 0.545 turtle mortality associated with the 109 trawl captures in combined state and federal waters trawling; therefore, to be conservative, we estimate that one sea turtle may die from relocation trawling injuries during this project. Because we cannot predict if this event will occur in state or federal waters, we will assume that this capture-mortality will occur in the phase of the project that occurs in federal waters. Based on STSSN data from the action area, this trawl capture mortality, if it occurs, will most likely be either a loggerhead or a green sea turtle.

Estimated Smalltooth Sawfish Captures by Relocation Trawling
Previous relocation trawling activities in the project area captured no smalltooth sawfish. However, as discussed previously, one smalltooth sawfish was captured in August 2006 in a relocation trawl during the Egmont Key channel dredging, north of the current proposed action area. Thus, while this project is approximately 40 miles north of the center of the species' distribution and critical habitat, the Egmont Key channel project was still further away, yet captured a large (approximately 20-ft male) sawfish during relocation trawling associated with the dredging activities. The animal was released alive and unharmed. Therefore, we estimate that relocation trawling activities during this project may result in the incidental, non-injurious capture of one smalltooth sawfish in federal waters. Trawler interactions with smalltooth sawfish in state waters are not anticipated to occur and were deemed discountable in the GRBO.

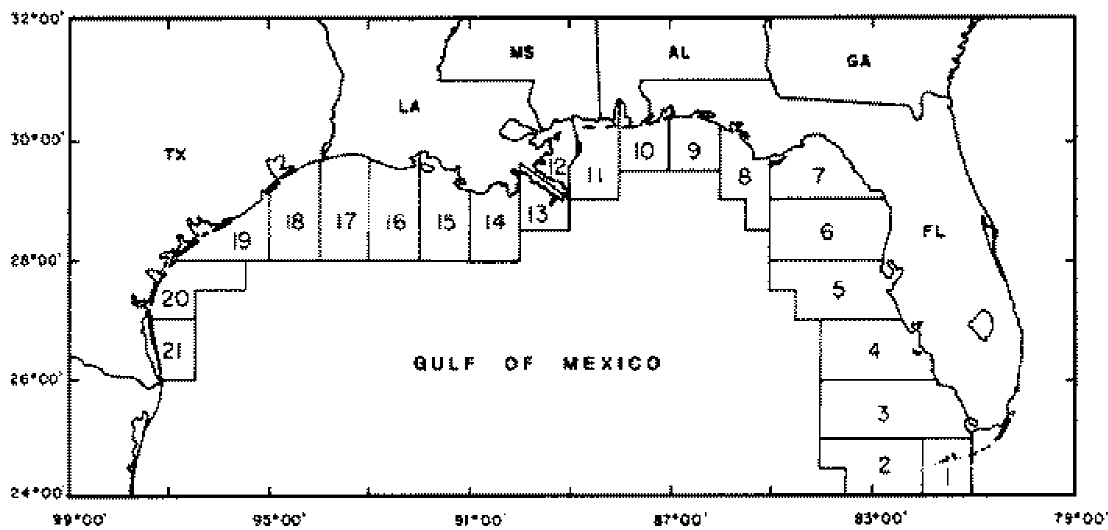

Figure 5.0.1. STSSN statistical zone map.

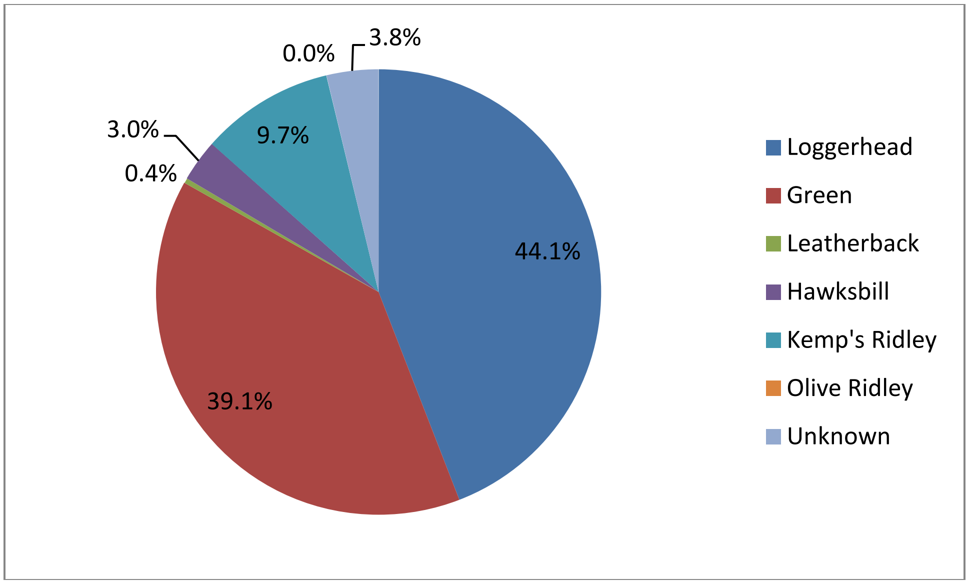

Figure 5.0.2. STSSN stranding data for statistical zone 5 for 2008-2010.

Relocation Trawling

The function and purpose of capture relocation trawling is to capture sea turtles that may be in the dredge's path and relocate them away from the action area. By reducing the sea turtle density immediately in front of the dredge's suction dragheads, the potential for draghead-turtle interactions is reduced. Even though relocation trawling involves the direct (not incidental) capture and collection of sea turtles, we determined it constitutes a legitimate reasonable and prudent measure (RPM) in past biological opinions on hopper dredging because it reduces the level of almost certain injury and mortality of sea turtles by hopper dredges, and it allows the sea turtles captured non-injuriously by trawl to be relocated out of the path of the dredges. Without relocation trawling, the number of sea turtle mortalities resulting from hopper dredging would likely be significantly greater than the estimated number discussed above and specified in the ITS. The Consultation Handbook (for Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act, U.S. Fish and Wildlife Service and National Marine Fisheries Service, March 1998) expressly authorizes such directed interactions as an RPM (page 4-54).

The relocation trawler typically pulls two, standard (60-foot headrope), shrimp trawl nets, as close as safely possible in front of the advancing hopper dredge. The trawler also continues sweeping the area to be dredged (channels or borrow areas) even while the hopper dredge is not actively dredging, e.g., when the dredge is enroute to pipelines or disposal areas. Relocation trawling has been successful at temporarily displacing Kemp's ridley, loggerhead, hawksbill, and green sea turtles from channels in the Atlantic Ocean and Gulf of Mexico during periods when hopper dredging was imminent or ongoing (Dickerson et al. 2007). Historically, relocation trawling has been used to reduce turtle interactions with the dredge by capturing turtles in a modified shrimp net, bringing them onboard the trawler, and transporting them approximately 3-5 miles from the dredging site where they are released into the ocean. Dickerson et al. (2007) 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. The effects of relocation trawling on sea turtles will be further discussed below.

Effects of Recapture during Relocation Trawling
Some sea turtles captured during relocation trawling operations return to the dredge site and subsequently are recaptured. For example, sea turtle relocation studies by Standora et al. (1993) at Canaveral Channel, Florida, relocated 34 turtles to six release sites of varying distances north and south of the channel. Ten turtles returned from southern release sites, and seven from northern sites, suggesting that there was no significant difference between directions. The observed return times from the southern release sites suggested a direct correlation between relocation distance and likelihood of return or length of return time to the channel. No correlation was observed between the northern release sites and the time or likelihood of return. The study found that relocation of turtles to the site 70 km (43 miles) south of the channel would result in a return time of over 30 days. Over a 7-day period in February 2002, REMSA, a private company contracted to conduct relocation trawling, captured, tagged, and relocated 69 turtles (55 loggerheads and 14 greens) from Canaveral Channel, Florida, with no recaptures; turtles were relocated a minimum of 3 to 4 miles away (T. Bargo, REMSA, pers. comm. to Eric Hawk, NMFS SER, June 2, 2003). Twenty-four hour per day relocation trawling conducted by REMSA at Aransas Pass Entrance Channel (Corpus Christi Ship Channel) from April 15, 2003, to July 7, 2003, resulted in the relocation of 71 turtles (56 loggerheads, 15 Kemp's ridleys, and 1 leatherback) between 1.5 and 5 miles from the dredge site, with 3 recaptures, all loggerheads (T. Bargo, REMSA, pers. comm. to Eric Hawk, NMFS SER, July 24, 2003). One turtle released on June 14, 2003, approximately 1.5 miles from the dredge site, was recaptured four days later at the dredge site; another turtle captured June 9, 2003, and released about 3 miles from the dredge site was recaptured nine days later at the dredge site. Subsequent releases occurred five miles away. Of these 68 subsequent capture/releases, one turtle released on June 22, 2003, was recaptured 13 days later (REMSA Final Report, Sea Turtle Relocation Trawling, Aransas Pass, Texas, April-July 2003) at the dredge site. Over the course of 15 days of dredging and associated turtle relocation trawling conducted between July 9 and 23, 2010, for the construction of 35 miles of oil-barrier sand-berms at Hewes Point, Chandeleur Islands, Louisiana, resulted in 194 sea turtle trawl-captures and relocations (185 loggerheads, 8 Kemp's ridleys, and 1 green), with 11 turtles recaptured (all loggerheads) at the sand borrow site after being relocated at least 3 miles away from the dredge site (L. Brown, COE, pers. comm. via e-mail to E. Hawk, NMFS, February 22, 2011). The channel maintenance dredging project at Gulfport, Mississippi, relocated 71 turtles, with one recapture, from April 23-July 27, 2011.

Trawling that occurred over 200 days in the Town's renourishment project during 2005-2006 relocated 129 turtles (74 loggerheads, 41 Kemp's ridley, 12 greens, and 2 hawksbills) with only two recaptures (one Kemp's ridley, one not noted) occurring. More recently, from April 11-June 11, 2011, during the most recent Longboat Key beach nourishment project, 23 sea turtles were captured and relocated (20 loggerheads, two Kemp's, and one green). One, a large, sexually-mature male loggerhead, was captured at the borrow site (and relocated) three times, released each time at least 3-5 miles away from the capture site, each time in a different compass direction from the borrow site. The last time, the turtle was released with a satellite transmitter attached (E. Hawk, NMFS, pers. comm. June 13, 2011). Table 5.0.1 below compares the various recapture rates for relocation trawling.

Table 5.0.1. Comparison of Recapture Rates for Relocation Trawling.

Number of Turtles Released/Relocated	Relocation Distance from dredge site	Number of Turtles Recaptured	Recapture Timing	Citation
34	43 miles (Southern release site)	10	> 30 days	Standora et al. (1993); Cape Canaveral, Florida
69	Minimum 3-4 miles	0	N/A	T. Bargo, REMSA, pers. comm. to Eric Hawk, NMFS SER, June 2, 2003; Cape Canaveral, Florida
71	1.5-5 miles	3	4-13 days	REMSA Final Report, Sea Turtle Relocation Trawling, Aransas Pass, Texas, April-July 2003
194	Minimum 3 miles	11	15 days	L. Brown, COE, pers. comm. via e-mail to E. Hawk, NMFS, February 22, 2011; Hewes Point, Chandeleur Islands, Louisiana
129	Minimum 3 miles	2	28 days	Coastwise Consulting, Final Report on the Monitoring and Mitigation Impacts to Protected Species During Beach Restoration at Longboat Key, Florida, 2005-2006.
71	3-5 miles	1	46 days	Coastwise Consulting, Inc. Gulfport, MS dredging project; pers. comm. to Eric Hawk, NMFS SER, August 1, 2011

The capture and handling of sea turtles can result in raised levels of stressor hormones, and can cause some discomfort during tagging procedures; based on past observations obtained during similar research trawls for turtles, these physiological effects are expected to dissipate within a day (Stabenau and Vietti 1999). During the course of 1,600 days of relocation trawling at Wilmington, North Carolina, Kings Bay and Savannah, Georgia, Pensacola, Florida, and Sabine

Pass, Galveston, Freeport, Matagorda Pass, and Corpus Christi, Texas, Coastwise Consulting, Inc., successfully captured, tagged, and released over 770 loggerhead, Kemp's ridley, green, and hawksbill, and leatherback sea turtles (C. Slay, Coastwise Consulting, pers. comm. via e-mail to E. Hawk, NMFS, January 25, 2007). Only one leatherback mortality was documented and attributed to illegal artificial reef material deployed within a designated borrow area; the trawl net that captured the leatherback got entangled on the reef material and the trawler was unable to haul its nets within the 42 minutes required by the GRBO and the turtle drowned before the net was able to be freed and brought to the surface. On the Atlantic coast, REMSA also successfully tagged and relocated over 140 turtles in the last several years, most notably, 69 turtles (55 loggerheads and 14 greens) in a 7-day period at Canaveral Channel in October 2002, with no significant injuries. Other sea turtle relocation contractors (R. Metzger in 2001; C. Oravetz in 2002) have also successfully and non-injuriously trawl-captured and released sea turtles out of the path of oncoming hopper dredges. In the Gulf of Mexico, in 2003, REMSA captured, tagged, and relocated 71 turtles at Aransas Pass, Texas, with no apparent long-term ill effects to the turtles. Three injured turtles captured were transported to University of Texas Marine Science Institute rehabilitation facilities for treatment (two had old, non-trawl related injuries or wounds; the third turtle may have sustained an injury to its flipper, apparently from the door chain of the trawl, during capture). Three of the 71 captures were recaptures and were released around 1.5, 3, and 5 miles, respectively, from the dredge site; none exhibited any evidence their capture, tag, release, and subsequent recapture, was in any way detrimental (T. Bargo, REMSA, pers. comm. to E. Hawk, NMFS, June 2, 2003). Given that sea turtle recaptures are relatively infrequent, and recaptures that do occur typically happen several days to weeks after initial capture, cumulative adverse effects from recapture are not expected.

Relocation Trawling Tow-Time Effects on Sea Turtles
The Commission on Life Sciences (1990) reported the proportion of sea turtles caught in nets that are dead or comatose increased with an increase in tow time from 0 percent during the first 50 minutes to about 70 percent after 90 minutes. The National Research Council (NRC) report "Decline of the Sea Turtles: Causes and Prevention" (NRC 1990) suggested that limiting tow durations to 40 minutes in summer and 60 minutes in winter would yield sea turtle survival rates that approximate those required for the approval of new TED designs, i.e., 97 percent. The NRC report also concluded that mortality of turtles caught in shrimp trawls increases markedly for tow times greater than 60 minutes. Current NMFS TED regulations allow, under very specific circumstances, for shrimpers with no mechanical-advantage trawl retrieval devices on board, to be exempt from TED requirements if they limit tow times to 55 minutes during April through October and 75 minutes from November through March. The presumption is that these tow time limits will result in turtle survivability comparable to having TEDs installed.

Rarely, properly conducted relocation trawling can result in accidental sea turtle deaths, as the following examples illustrate. Henwood (T. Henwood, pers. comm. to E. Hawk, December 6, 2002) noted that trawl-captured loggerhead sea turtles died on several occasions during handling on deck during winter trawling in Canaveral Channel in the early 1980s, after short (approximately 30 minutes) tow times. However, Henwood also noted that a significant number of the loggerheads captured at Canaveral during winter months appeared to be physically stressed and in "bad shape" compared to loggerheads captured in the summer months from the same site that appeared much healthier and robust. In November 2002, during relocation trawling conducted in York Spit, Virginia, a Kemp's ridley sea turtle was likely struck by one of the heavy trawl doors or it may have been struck and killed by another vessel shortly before trawl net capture. The hopper dredge was not working in the area at the time (T. Bargo, pers. comms. and e-mails to E. Hawk, December 6 and 9, 2002). Additionally, during relocation trawling conducted off Destin, Florida, on December 2, 2006, a leatherback turtle was captured and killed. However, this mortality by drowning occurred after the trawler encountered and entangled its trawl net on a large section of uncharted bottom debris, and was unable to retrieve it from the bottom for several hours (C. Slay, pers. comms. and e-mails to E. Hawk, December 4, 2006; see also Dickerson et al. 2007). Over 15 days of dredging and associated turtle relocation trawling conducted between July 9 and 23, 2010, for the construction of 35 miles of oil-barrier sand-berms at Hewes Point, Chandeleur Islands, Louisiana, 194 sea turtles were trawl-captured, with 3 mortalities in 584 thirty-minute tows, or a 1.5 percent mortality rate (R. Crabtree, NMFS, letter to COE, dated January 14, 2011). NMFS considers that this rate is unusually high, given the last two decades of relocation trawling experience. The reason for the unusually high level of relocation trawler turtle mortalities associated with the berm project is unknown. At Mayport, Florida, channel dredging in April 2011, a green turtle was drowned when it entangled in an improperly designed non-capture trawl net (non-capture trawl nets have typical tow times of 3-4 hours).

Since 1991, the COE has documented more than 65 hopper-dredging projects in the South Atlantic and Gulf of Mexico where a trawler was used as part of the project, consisting of thousands of individual tows of relocation trawling nets. In addition, the COE has also conducted or permitted abundance assessments and/or project-specific relocation trawling of sea turtles in navigation channels and sand borrow areas in the Southeast and Gulf of Mexico using commercial shrimp vessels equipped with otter trawls (COE Sea Turtle Data Warehouse; D. Dickerson 2007). On eight occasions a turtle has been killed or injured by a relocation trawler (six in the Gulf of Mexico and two in the South Atlantic) over the same 20-year period (COE Sea Turtle Warehouse; pers. comm. T. Jordan, COE, to E. Hawk, NMFS, May 23, 2011).

Current NMFS SER opinions typically limit tow times for relocation trawling to 42 minutes or less, measured from the time the trawl doors enter the water when setting the net to the time the trawl doors exit the water during haulback ("doors in – doors out"). This approximates 30 minutes of bottom-trawling time. As previously stated, the COE limits authorized relocation trawling time in association with hopper dredging and its limit is at least as conservative in terms of allowable tow times as NMFS'; the COE's current hopper dredging/relocation trawling protocol limits capture-trawling relocation tow times to 30 minutes or less, doors in to doors out. Overall, the significantly reduced tow times used by relocation trawling contractors, compared to those used during the 1998 studies on the effects of unrestricted, 55-minute, and 75-minute tow times, leads NMFS to conclude that current relocation trawling mortalities occur (and will continue to occur) at a much lower rate. Recent relocation trawling data bears this out strikingly: from October 1, 2006, to June 14, 2011, COE dredging projects relocated 1,216 turtles in the Gulf of Mexico and South Atlantic; there were only 5 documented trawling-related mortalities during those relocation events, or 0.4 percent overall (COE Sea Turtle Data Warehouse, queried June 14, 2011), including the three aforementioned Chandeleur Islands mortalities in 2010.

Total Impact of Relocation Trawling on Sea Turtles

Even though relocation trawling involves the capture and collection of sea turtles, it has constituted a legitimate reasonable and prudent measure (RPM) in past NMFS biological opinions on hopper dredging because it reduces the level of almost certain injury and mortality of sea turtles by hopper dredges, and it allows the sea turtles captured non-injuriously by trawl to be relocated out of the path of the dredges. Without relocation trawling, the number of sea turtle mortalities resulting from hopper dredging would likely be significantly greater than the estimated number discussed above and specified in the ITS. The Consultation Handbook (for Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act, U.S. Fish and Wildlife Service and National Marine Fisheries Service, March 1998) expressly authorizes such directed interactions as an RPM at page 4-54. Therefore, in this section we will evaluate the expected number of sea turtles collected or captured during required relocation trawling, so that these numbers can be included in the evaluation of whether the proposed action will jeopardize the continued existence of the species.

We believe that properly conducted and supervised relocation trawling (i.e., observing NMFS-recommended trawl speed, low tow-time limits, and taking adequate precautions to release captured animals) and tagging is unlikely to result in adverse effects (i.e., injury or death) to sea turtles. As discussed above, we estimate that, overall, sea turtle trawling and relocation efforts will result in considerably less than 0.5 percent mortality of captured turtles, with any mortalities that do occur being primarily due to the turtles being previously stressed or diseased or struck by trawl doors or suffering accidents on deck during codend retrieval and handling. On the other hand, hopper dredge entrainments invariably result in injury, and are almost always fatal.

The number of sea turtles collected or captured by trawlers in association with hopper dredging projects varies considerably by project area, amount of effort, and time of year. Additionally, sea turtle distribution can be very patchy, resulting in significant differences in number of turtle captures by relocation trawler, and in some areas, one species may dominate the captures. For example, Canaveral, Florida, is known for its abundance of green turtles; Calcasieu, Louisiana, and Gulfport, Mississippi for their almost exclusive capture of Kemp's ridleys; Brunswick, Georgia, and Mississippi-River Gulf Outlet, Louisiana, captures are predominantly loggerheads (E. Hawk, NMFS, pers. comm., June 13, 2011).

Between October 2011 and June 14, 2011, of the 1,216 turtle captures by relocation trawler, the majority (1,145) occurred in the Gulf of Mexico, while 71 occurred in the South Atlantic (COE Sea Turtle Data Warehouse, June 14, 2011 data). Dickerson et al. (2007) evaluated the effectiveness of relocation trawling for reducing incidental interactions with sea turtles by analyzing incidental interactions recorded in endangered species observer reports, relocation trawling reports, and hopper dredging project reports from 1995 through 2006. From 1995 through 2006, 319 hopper dredging projects throughout the Gulf of Mexico (n=128) and Atlantic Ocean (n=191) used endangered species monitoring and a total of 358 dredging-related sea turtle interactions were reported (Regions: Gulf=147 sea turtles; Atlantic=211 sea turtles). During the 70 projects with relocation trawling efforts, 1,239 sea turtles were relocated (Regions: Gulf=844; Atlantic=395). Loggerhead is the predominant species for both dredge interactions and relocation trawling interactions with sea turtles. Kemp's ridleys rank second. Green turtles have been captured in trawls only during December through March in the Gulf of Mexico. Two hawksbills and 6 leatherbacks were relocated during 1995-2006.

The number of sea turtles captured by relocation trawlers does not directly translate into potential mortalities by hopper dredges in the absence of relocation trawling, due to the differences in footprint between the two gear types. The spread of a relocation trawler's net is much greater than the width of a hopper dredge's dragheads; therefore, the trawler will encounter a significantly greater number of sea turtles. Mostly non-injurious interactions may be expected with the implementation of relocation trawling.

Flipper Tagging

Flipper tagging is not expected to have any detrimental effects on captured animals. Tagging prior to release will help us learn more about the habits and identity of trawl-captured animals after they are released, and if they are recaptured the data will enable improvements in relocation trawling design to further reduce the effect of the hopper dredging activities. External and internal flipper tagging is not considered a dangerous procedure by the sea turtle research community, is routinely done by thousands of volunteers in the United States and abroad, and can be safely accomplished with minimal training. We know of no instance where flipper tagging has resulted in mortality or serious injury to a trawl-captured sea turtle. Such an occurrence would be extremely unlikely because the technique of applying a flipper tag is minimally traumatic and relatively non-invasive; in addition, these tags are attached using sterile techniques. Important growth, life history, and migratory behavior data may be obtained from turtles captured and subsequently relocated. Therefore, these turtles should not be released without tagging (and prior scanning for pre-existing tags).

Genetic Sampling

Taking skin tags or biopsy punches is not expected to have any detrimental effects on captured animals. Analysis of genetic samples may provide information on sea turtle populations such as life history, nesting beach identification, and distribution/stock overlap. This may ultimately lead to enhanced sea turtle protection measures. Tissue sampling is performed to determine the genetic origins of captured sea turtles, and learn more about turtle nesting beach/population origins. This is important information because some populations or recovery units may be declining. For all tissue sample collections, a sterile 4- to 6-mm punch sampler is used. Researchers who examined turtles caught two to three weeks after sample collection noted that the sample collection site was almost completely healed (Witzell, pers. comm.). We do not expect the collection of a tissue sample from each captured turtle to cause any additional stress or discomfort to the turtle beyond that experienced during capture, collection of measurements, and tagging.

6.0 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions reasonably certain to occur within the action area considered in this opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

Cumulative effects from unrelated, non-federal actions occurring in the Gulf may affect sea turtles and smalltooth sawfish and their habitats. Stranding data indicate sea turtles in Gulf waters die of various natural causes, including cold stunning and hurricanes, as well as human activities, such as incidental capture in state fisheries, ingestion of and/or entanglement in debris, ship strikes, and degradation of nesting habitat. The cause of death of most sea turtles recovered by the stranding network is unknown.

The fisheries occurring within the action area are expected to continue into the foreseeable future. Numerous fisheries in state waters along the Gulf coast have also been known to adversely affect threatened and endangered sea turtles and the endangered smalltooth sawfish. We are not aware of any proposed or anticipated changes in these fisheries that would substantially change the impacts each fishery has on the sea turtles and smalltooth sawfish covered by this opinion.

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

7.0 Jeopardy Analysis

This section evaluates the likelihood that the proposed action will jeopardize the continued existence of green, hawksbill, Kemp's ridley, and loggerhead sea turtles and smalltooth sawfish in the wild. To *jeopardize the continued existence of* is defined as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Section 3 describes the status of the species affected by the proposed action. Section 5 describes the effects of the proposed action on green, hawksbill, Kemp's ridley, loggerhead sea turtles and smalltooth sawfish, and the extent of those effects in terms of an estimate of the number of sea turtles or smalltooth sawfish that would be killed or otherwise taken. The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. As explained above, the effects and jeopardy analyses of this opinion consider the full effects of BOEM's proposed action, including effects of interdependent and interrelated dredging and renourishment activities under the jurisdiction of the COE.

To summarize, we estimated the following most-probable scenario of quantities of take by species, for state and federal waters combined, to be:
Loggerhead and green sea turtles: lethal take of up to 3 total (2 documented and 1 unobserved) loggerhead or green sea turtles (in any combination) by hopper dredge in state and federal waters.
Loggerhead sea turtle: non-lethal take of 49 loggerhead turtles by relocation trawling (14 in federal waters and 35 in state waters).

Green sea turtle: non-lethal take of 43 green turtles by relocation trawling (12 in federal waters and 31 in state waters).
Kemp's ridley sea turtle: non-lethal take of 11 Kemp's ridleys by relocation trawling (3 in federal waters and 8 in state waters).
Hawksbill sea turtle: non-lethal take of 4 hawksbill turtles by relocation trawling (1 in federal waters and 3 in state waters).
Leatherback sea turtle: non-lethal take of 2 leatherback sea turtle by relocation trawling (1 each in federal waters and state waters).
Smalltooth sawfish: non-lethal take of one smalltooth sawfish in either state or federal waters.

In the following analysis, we discuss the anticipated takes of these listed species in the context of the best available information on their current population statuses and trends, the environmental baseline, and cumulative impacts.

Our jeopardy analysis first considers if we would reasonably expect the action to result in reductions in reproduction, numbers, or distribution of these sea turtle species or smalltooth sawfish (including reductions that may not necessarily be observed, as discussed in Section 5). The analysis next considers whether any such reduction would in turn result in an appreciable reduction in the likelihood of survival of these species in the wild, and the likelihood of recovery of these species in the wild. In sum, we evaluated whether or not any anticipated take of that species will result in any reduction in reproduction, numbers, or distribution of that species that may appreciably increase a species' risk of extinction, or appreciably interfere with achieving recovery objectives, in the wild.

In the following analyses, we find that although some reduction in numbers and reproduction is expected for green and loggerhead sea turtles species as a result of anticipated lethal takes by hopper dredging of these species, the anticipated lethal take of green, and loggerhead sea turtles—and the anticipated non-lethal take (by relocation trawling) of hawksbill, Kemp's ridley, and leatherback sea turtles, and smalltooth sawfish—will not appreciably increase the risk of extinction of these species in the wild, or appreciably interfere with achieving recovery objectives for the species.

Sea Turtles
All sea turtle life stages are important to the survival and recovery of the species; however, it is important to note that individuals of one life stage are not equivalent to those of other life stages. For example, the take of male juveniles may affect survivorship and recruitment rates into the reproductive population in any given year, and yet not significantly reduce the reproductive potential of the population. For sea turtles, a very low percent of hatchlings is typically expected to survive to reproductive age. The death of mature, breeding females can have an immediate effect on the reproductive rate of the species. Sub-lethal effects on adult females may also reduce reproduction by hindering foraging success, as sufficient energy reserves are probably necessary for producing multiple clutches of eggs in a breeding year. Different age classes may experience varying rates of mortality and resilience.

Loggerhead Sea Turtles

The non-lethal capture of 49 loggerheads will not result in a reduction in the species' numbers because relocation efforts are not expected to result in mortality, whereas hopper dredge entrainments invariably result in injury, and are almost always fatal. The lethal take of up to 3 loggerhead sea turtles by hopper dredge would result in an instantaneous, but temporary reduction in total population numbers. Thus, the proposed action will result in a reduction of sea turtle numbers. Sea turtle mortality resulting from hopper dredges could result in the loss of reproductive value of an adult turtle. 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 loss of two adult female sea turtles during the 10-year project could preclude the production of thousands of eggs and hatchlings, of which a small percentage is expected to survive to sexual maturity. Thus, the death of an adult female eliminates an individual's contribution to future generations, and the action will result in a reduction in loggerhead sea turtle reproduction.

Considering their population sizes in the western North Atlantic, we believe loggerhead sea turtle populations are sufficiently large enough to persist and recruit new individuals to replace those expected to be lethally taken. We use the following estimates for loggerhead sea turtle populations to support our determination.

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

Based on the total numbers of adult females and benthic females estimated by NMFS SEFSC for the western North Atlantic population of loggerhead sea turtles, the anticipated lethal take of up to 3 loggerheads resulting from the proposed action represents the removal of, at most, approximately 0.015 percent (3/20,000 x 100) of the estimated adult loggerhead female population.

The Services' recovery plan for the Northwest Atlantic population of the loggerhead turtle (NMFS and USFWS 2009), which is in essence the same population of turtles as comprise the NWA DPS, provides additional explanation of the goals and vision for recovery for this population. The objectives of the recovery plan most pertinent to the threats posed by hopper dredging associated activities are numbers 1, 11, and 13:

1. Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females….
11. Minimize trophic changes from … habitat alteration….
13. Minimize vessel strike mortality.

The recovery plan anticipates that, with implementation of the plan, the western North Atlantic population will recover within 50 to 150 years, but notes that reaching recovery in only 50 years would require a rapid reversal of the declining trends of the Northern, Peninsular Florida, and Northern Gulf of Mexico Recovery Units.

The potential lethal take of up to 3 loggerheads over the duration of the project will result in reduction in numbers when take occurs 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. The expected 49 non-lethal takes from relocation trawling are not expected to impact the reproductive potential, fitness, or growth of the captured sea turtle because they will be immediately released unharmed, or released with only minor injuries from which they are expected to fully recover, or be rehabilitated prior to release. Thus, the proposed action will not interfere with achieving the recovery objectives and will not result in an appreciable reduction in the likelihood of loggerhead sea turtles' recovery in the wild.

Green Sea Turtles
The anticipated lethal take of up to 2 documented and 1 unobserved green turtle is a reduction in numbers. These lethal takes, as well as the non-lethal take of 43 due to relocation trawling, is expected to result in a reduction in reproduction as well, as a result of reductions in fitness and growth prior to maturity of any juveniles that are captured and the disturbance to nesting activities of any females attempting to nest on the Town's beach.

The most up-to-date data provided by CP&E indicates that since 2001, only four nests have been recorded (one in 2003, one in 2004, two in 2007, and one in 2008) on Longboat key. This does not account for the fact that green turtle nesting has been steadily increasing in Florida in recent years. Based upon statewide nesting data from FWC, green sea turtle nests have increased by a factor of ten since 1989 (FWRI 2010). However, this increase has not been as dramatic on the west coast of Florida or on Longboat Key.

As reported in the August 2007 ESA 5-year review of the green sea turtle (NMFS and USFWS 2007a), nesting populations are stable or increasing in all rookery areas in the Western Atlantic Ocean, including rookeries in Costa Rica, Florida, Mexico, Venezuela, and Suriname.
Further, based on the results from the first 24 years of an ongoing study of the composition, population structures, and population trends of green sea turtles in the central region of the Indian River Lagoon in Florida, Ehrhart et al. (2007) reported a 661-percent increase in juvenile green turtle capture rates at their study area. This increase in capture rates is similar to those recorded at the St. Lucie Power Plant over a similar period (Wilcox et al. 1998). During the 24-

year period studied by Ehrhart et al. (2007), green turtle nest deposition in Florida has increased exponentially. Since 1982, Ehrhart et al. (2007) have surveyed marine turtle nesting on a 21-km stretch of beach in southern Brevard County, Florida, now part of the Archie Carr National Wildlife Refuge. From 1990-91 to 2004-05, green turtle nest deposition increased 358 percent in southeast Florida (Ehrhart et al. 2007). Since 1989, the Florida Fish and Wildlife Research Institute's results of monitoring from index nesting beaches shows that 90 percent of Florida green turtle nest deposition occurs in southeast Florida (Brevard through Miami-Dade Counties). The pattern of green sea turtle nesting shows biennial peaks in abundance since establishment of index beaches in Florida in 1989. There has been a generally positive trend during the twenty one years of regular monitoring.

Green sea turtles are highly migratory, and individuals from all Atlantic nesting populations may range throughout the Gulf of Mexico, Atlantic Ocean, and Caribbean Sea. While the potential lethal take and relocation of turtles captured in trawls would result in a displacement of individuals from important developmental habitat, the loss is not significant in terms of local, regional, or global distribution as a whole. The Florida population distribution would be expected to remain the same. Therefore, we believe the anticipated impacts will not affect the species' distribution.

We believe that the expected impact of up to 3 green sea turtle mortalities represents an adverse impact to the species. However, this species is currently showing a very large increasing nesting trend in Florida, with nesting numbers already approaching or exceeding those required by the recovery plan for the species. Therefore, we believe that the reduction in reproduction as a result of the anticipated takes detailed above is not expected to appreciably reduce the likelihood of survival of the species, and the reduction in species numbers is not expected to appreciably reduce the likelihood of survival of green sea turtles in the wild.

We also consider the recovery objectives in the recovery plan prepared for the U.S. populations of green sea turtles that may be affected by the predicted reduction in numbers and reproduction. The recovery plan for green sea turtles (NMFS and USFWS 1991) lists the following relevant recovery objectives:

(1) The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years. Nesting data must be based on standardized surveys.

    Status: 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). That average increased to 7,436 nests per year for the 6-year period of 2004-2009. Data from the index nesting beach program in Florida support the dramatic increase in nesting. In 2007, there were 9,455 green turtle nests found just on index nesting beaches, the highest since index beach monitoring began in 1989. The number fell back to 6,385 in 2008, but that is thought to be part of the normal biennial nesting cycle for green turtles (FWC Index Nesting Beach Survey Database). An additional drop to just below 3,000 nests was seen on the index nesting beaches in 2009, but the occasional break from the normal biennial pattern is not without precedent, as there were two consecutive years of increase from 2003-2005 (FWC Index Nesting Beach Survey Database). Preliminary nesting data for 2010 show an increase in green turtle nests (Anne Meylan –FWRI, pers. comm.).

(2) A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.

Status: There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas (where they come to forage) of the southeastern United States. However, information on incidental captures of immature green sea turtles at the St. Lucie Power Plant (they have averaged 215 green sea turtle captures per year since 1977) in St. Lucie County, Florida, show that the annual number of immature green sea turtles captured has increased significantly in the past 26 years (FPL 2002). Ehrhart et al. (2007) has also documented a significant increase in in-water abundance of green turtles in the Indian River Lagoon area.

The expected lethal takes described above will result in a reduction in numbers and reproduction, but will not have any detectable influence on the population and nesting trends noted above. The average loss per year will not have an appreciable impact on total recruitment of new sea turtles to the population given the extent of the impact versus the very rapid population increases occurring over the past decade. The estimated non-lethal take described above would not affect these trends either as they are not expected to impact the survival, distribution, or fecundity of individuals taken in an appreciable manner relative to the population size. Thus, the proposed action will not interfere with achieving the recovery objectives above and will not result in an appreciable reduction in the likelihood of green sea turtles' recovery in the wild.

Kemp's Ridley Sea Turtles
As demonstrated by nesting increases at the main nesting sites in Mexico, adult ridley numbers have increased over the last decade. The population model used by TEWG (2000) projected that Kemp's ridleys could reach the recovery plan's intermediate recovery goal of 10,000 nesters by the year 2015. Recent calculations of nesting females determined from nest counts show that the population trend is increasing towards that recovery goal, with an estimate of 4,047 nesters in 2006 and 5,500 in 2007 (NMFS 2007, Gladys Porter Zoo 2007). Recent nesting data indicated a population of an estimated 8,460 females in 2009 and 5,320 females in 2010 (J. Peña, Gladys Porter Zoo, pers. comm. to S. Heberling, NMFS, March 21, 2011). Based on this information, the anticipated non-lethal take of up to 11 Kemp's ridley sea turtles by relocation trawling would not be expected to have a detectable effect on the Kemp's ridley sea turtle population.

The non-lethal take of 11 Kemp's ridleys by relocation trawling over the 10-year duration of the proposed project (only 168 days of work in the action area) could potentially result in short-term effects on individuals; however, these effects do not constitute an appreciable reduction in reproduction and numbers. Changes in distribution, even short-term, are not expected from non-lethal takes (interactions/releases from relocation trawling, vessel strikes, etc.) during the project. Interactions with vessels and/or relocation trawlers may elicit startle or avoidance responses and the effects of the proposed action may result in temporary changes in behavior of sea turtles (minutes to hours) over small areas, but are not expected to reduce the distribution of any sea turtles in the action area. The relocation of up to 11 Kemp's ridleys is anticipated during the proposed project. Because all potential take is expected to occur anywhere in the action area 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 these individuals.

Based on the above analysis, we believe that the non-lethal take of 11 Kemp's ridley sea turtles associated with the proposed action is not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of these species in the wild.

The following analysis considers the effects of the take on the likelihood of recovery in the wild. We consider the recovery objectives in the recovery plan prepared for the Kemp's ridley sea turtle that relate to population numbers or reproduction that may be affected by the proposed action.

The recovery plan for Kemp's ridley sea turtles (USFWS and NMFS 1992), herein incorporated by reference, lists the following relevant recovery objective: Attain a population of at least 10,000 females nesting in a season.

The potential relocation of 11 Kemp's ridleys will not result in a reduction in overall population numbers in any given year. We already have determined this take is not likely to reduce population numbers over time due to current population sizes and expected recruitment. Capture of sea turtles by relocation trawlers will not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action will not result in an appreciable reduction in the likelihood of Kemp's ridleys sea turtles recovery in the wild.

Hawksbill Sea Turtles
No reductions in numbers of hawksbill sea turtles are expected as a result of the proposed action. Additionally, only four hawksbill turtles are expected to be captured (non-injuriously) by relocation trawling. This take is not expected to appreciably reduce the likelihood of survival of hawksbill sea turtles in the wild.

Hawksbill sea turtles are highly migratory, and individuals may range throughout the Gulf of Mexico, Atlantic Ocean, and Caribbean Sea. While the potential take could result in a loss of reproductive value for the action area if the captures interrupted nesting activity, the loss is not significant in terms of local, regional, or global distribution as a whole, especially given the very minimal nesting by hawksbills in the action area and surrounding beaches. Therefore, we believe the anticipated impacts will not affect the species' distribution and are not expected to appreciably reduce the species' likelihood of survival in the wild.

We also consider the recovery objectives in the recovery plan prepared for the U.S. populations of hawksbill sea turtles that may be affected by the predicted reduction in numbers. The recovery plan for hawksbill sea turtles (NMFS and USFWS 1993) concludes that the U.S. populations of hawksbill turtles can be considered for delisting if, over a period of 25 years, the following recovery criteria are met:

(1) The adult female population is increasing, as evidenced by a statistically significant trend in the annual number of nests on at least five index beaches, including Mona Island and Buck Island Reef National Monument (BIRNM).

Status: To date hawksbill nesting on U.S. beaches does not show a clear trend. Hawksbill nesting is solitary, and often occurs at remote beaches. Nesting is also very limited, with Mona Island as the predominant site with only 500-1000 (Diez and van Dam 2006) nests per year, and thus determining a trend is difficult. The two largest nesting populations, Mona Island and BIRNM do appear to have been experiencing an increase over the last few decades (Meylan 1999) but the overall U.S. nesting shows no clear signs of recovery after the severe population reductions that occurred in the 20th century (NMFS and USFWS 1993, Meylan and Donnelly 1999).

(2) Numbers of adults, subadults, and juveniles are increasing, as evidenced by a statistically significant trend on at least five key foraging areas within Puerto Rico, USVI, and Florida.

Status: There are no reliable data to determine the trend of hawksbill turtle abundance in the key foraging areas within U.S. waters.

The potential take described above will not result in a reduction in numbers and reproduction, and will not have any detectable influence on the population and nesting trends noted. Thus, the proposed action will not interfere with achieving the recovery objectives above and will not result in an appreciable reduction in the likelihood of hawksbill sea turtles' recovery in the wild.

Leatherback Sea Turtles
The proposed action may result in 2 non-lethal captures of leatherback sea turtles by relocation trawling during the 10-year lease.

The non-lethal take of up to 2 leatherback sea turtles would not reduce the population. Therefore, we would not expect a reduction in future reproduction. The anticipated take is expected to occur anywhere in the action area and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of leatherback sea turtles is expected from the non-lethal take of an individual.

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

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

- The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico; St. Croix, USVI; and along the east coast of Florida.
  - In Puerto Rico, the main nesting areas are at Fajardo on the main island of Puerto Rico and on the island of Culebra. Between 1978 and 2005, nesting increased in Puerto Rico from a minimum of 9 nests recorded in 1978 and to a minimum of 469-

882 nests recorded each year between 2000 and 2005. Annual growth rate was estimated to be 1.1 with a growth rate interval between 1.04 and 1.12, using nest numbers between 1978 and 2005 (NMFS and USFWS 2007d).

- In the U.S. Virgin Islands, researchers estimated a population growth of approximately 13 percent per year on Sandy Point National Wildlife Refuge from 1994 through 2001. Between 1990 and 2005, the number of nests recorded has ranged from 143 (1990) to 1,008 (2001). The average annual growth rate was calculated as approximately 1.10 (with an estimated interval of 1.07 to 1.13) (NMFS and USFWS 2007d).
- In Florida, a Statewide Nesting Beach Survey program has documented an increase in leatherback nesting numbers from 98 (1989) to 800-900 (early 2000s). Based on standardized nest counts made at Index Nesting Beach Survey sites surveyed with constant effort over time, there has been a substantial increase in leatherback nesting in Florida since 1989. The estimated annual growth rate was approximately 1.18 (with an estimated 95 percent interval of 1.1 to 1.21) (NMFS and USFWS 2007d).

The potential non-lethal take of 2 leatherback sea turtles during the 10-year project lease is not likely to reduce population numbers, reproduction or distribution, as discussed above. Thus, we believe the proposed action is not likely to impede the recovery objectives above and will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild.

Smalltooth Sawfish
There is currently no reliable estimate of smalltooth sawfish abundance throughout its range. Although smalltooth sawfish encounter databases may provide a useful future means of measuring changes in the population and its distribution over time, including the current range, areas where recovery may be expected to occur, and the habitat needs of various size classes, available data is currently not robust enough to support such analysis. Conclusions about the current abundance of smalltooth sawfish cannot be made because outreach efforts and observation effort have not expanded evenly across each study period (Wiley 2010). However, based on genetic sampling, the estimates of current effective population size are 269.6 – 504.9 individuals (95% Confidence Interval 139.3 – 1515). (E-mail communication between Demian Chapman and Tonya Wiley, April 11, 2010). Chapman also states that this number is usually ½ - ¼ census population size (breeding adults, male and female) in elasmobranchs, so high hundreds to low thousands is a reasonable approximate range of the population size of extant breeders.

The recovery plan for smalltooth sawfish lists the following relevant recovery objectives:

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

The potential non-lethal take of one smalltooth sawfish during the 10-year project is not likely to reduce population numbers over time or decrease the species ability to reoccupy areas from which it has been previously extirpated.

8.0 Conclusion

Green, Hawksbill, Kemp's Ridley, Leatherback, and Loggerhead Sea Turtles
Based on the analyses of the proposed action on green, hawksbill, Kemp's ridley, leatherback, and the Northwest Atlantic DPS of loggerhead sea turtles, it is our opinion that the proposed action is not likely to jeopardize the continued existence of these species in the wild. Because the proposed action will not reduce the likelihood of survival and recovery of any Atlantic populations of sea turtles it is our opinion that the proposed project is also not likely to jeopardize the continued existence of green, hawksbill, Kemp's ridley, loggerhead, and leatherback sea turtles in the wild.

Smalltooth Sawfish
Based on the analyses of the proposed action on smalltooth sawfish, it is our opinion that the proposed project is not likely to jeopardize the continued existence of smalltooth sawfish.

9.0 Incidental Take Statement (ITS)

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

Section 7(b)(4)(c) of the ESA specifies that 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, BOEM must immediately notify (within 24 hours, if communication is possible) NMFS' Protected Resources Division in St. Petersburg, Florida, should a take of a listed marine mammal occur.

9.1 Anticipated Amount or Extent of Incidental Take

This ITS includes only incidental take resulting from actions in federal waters, i.e., those occurring under BOEM's authority. The ITS does not include activities occurring in state waters under the authority of the COE; the incidental take for that portion of the project is included in the ITS for the GRBO (NMFS Consultation Number F/SER/2000/01287). As such, the numbers of interactions/takes in the ITS are not the same as those used in Section 5.0 "Effects of the Action" or Section 7.0 "Jeopardy Analysis."

Sea Turtles
We anticipate that *documented* (i.e., by onboard observers) incidental take in federal waters, by injury or mortality, will consist of 1 green and 1 loggerhead sea turtle; and the *documented* incidental take, by non-injurious relocation trawling, will consist of 31 sea turtles (14

loggerheads, 12 greens, 3 Kemp's ridleys, 1 hawksbill, and 1 leatherback) during the estimated 47 days of the project in federal waters over its 10-year time frame. In addition, we anticipate that hopper dredging will result in 2 *unobserved* lethal takes of 1 green and 1 loggerhead.

Smalltooth Sawfish
We anticipate that one non-injurious incidental take of a smalltooth sawfish by relocation trawling will occur during the 47 days of the project in federal waters over the 10-year time frame.

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, Kemp's ridley, hawksbill, or leatherback sea turtles, or smalltooth sawfish.

9.3 Reasonable and Prudent Measures

Section 7(b)(4) of the ESA requires NMFS to issue a statement specifying the impact of any incidental take on listed species, which results from an agency action otherwise found to comply with Section 7(a)(2) of the ESA. It also states the reasonable and prudent measures (RPMs) necessary to minimize the impacts of take and the terms and conditions to implement those measures, must be provided and must be followed to minimize those impacts. Only incidental taking by the federal agency that complies with the specified terms and conditions is authorized.

The RPMs and terms and conditions are specified as required, by 50 CFR 402.01(i)(1)(ii) and (iv), to document the incidental take by the proposed action and to minimize the impact of that take on ESA-listed species. These measures and terms and conditions are non-discretionary, and must be implemented by the BOEM in order for the protection of Section 7(o)(2) to apply. The BOEM has a continuing duty to regulate the activity covered by this incidental take statement. If the BOEM fails to adhere to the terms and conditions through enforceable terms, and/or fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse.

NMFS has determined that the following reasonable and prudent measures must be implemented by the BOEM:

1) relocation trawling to minimize lethal entrainment of sea turtles in hopper dredges; and

2) monitoring and reporting on turtle and smalltooth sawfish interactions.

9.4 Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, the BOEM would be required to comply with the terms and conditions, which implement the RPMs.

The following terms and conditions implement the RPM for relocation trawling:

To temporarily reduce the abundance of listed species in the path of the hopper dredge and in order to reduce the possibility of lethal hopper dredge interactions, relocation trawling shall be conducted according to the following conditions:

a. *Trawl Time*: Trawl tow-time duration shall not exceed 42 minutes (doors in - doors out) and trawl speeds shall not exceed 3.5 knots.

b. *Handling During Trawling*: Sea turtles and smalltooth sawfish captured pursuant to relocation trawling 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).

c. *Captured Turtle Holding Conditions*: Captured turtles shall be kept moist, and shaded whenever possible, until they are released.

d. *Weight and Size Measurements*: All turtles shall be measured (standard carapace measurements including body depth) and tagged, and weighed when safely possible, prior to release; smalltooth sawfish shall be measured (fork length and total length) and–when safely possible–tagged, weighed, and a tissue sample taken prior to release. Any external tags shall be noted and data recorded into the observer's log. Only NOAA Fisheries-approved observers or observer candidates in training under the direct supervision of a NOAA Fisheries-approved observer shall conduct the tagging/measuring/weighing/tissue sampling operations.

e. *Take and Release Time During Trawling - Turtles*: Turtles shall be kept no longer than 12 hours prior to release (unless permission is received from NMFS SERO to hold them longer) and shall be released not less than 3 nautical miles (nmi) from the dredge site. If two or more released turtles are later recaptured, subsequent turtle captures shall be released not less than 5 nmi away. If it can be done safely, turtles may be transferred onto another vessel for transport to the release area to enable the relocation trawler to keep sweeping the dredge site without interruption.

f. *Take and Release Time During Trawling – Smalltooth Sawfish*: Smalltooth sawfish shall be released immediately after capture, away from the dredge site or into already dredged areas, unless the trawl vessel is equipped with a suitable well-aerated seawater holding tank (e.g., plastic "kiddie pool" not less than 1ft in depth by 5 ft in diameter), where a maximum of one sawfish may be held for not longer than 30 minutes before it must be released or relocated away from the dredge site.

g. *Injuries and Incidental Take Quota*: Any protected species injured or killed during or as a consequence of relocation trawling shall count toward the incidental take quota. Minor skin abrasions resulting from trawl capture are considered non-injurious. Injured sea turtles shall be immediately transported to the nearest sea turtle rehabilitation facility.

h. *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 NOAA Fisheries-approved endangered 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.

i. *Smalltooth Sawfish Tagging*: Tagging of live-captured smalltooth sawfish may also be done under the permitting authority of this opinion; however, it may be done only by personnel with prior fish tagging experience or training, and is limited to external tagging only, unless the observer holds a valid smalltooth sawfish research permit (obtained pursuant to Section 10 of the ESA, from the NOAA Fisheries' Office of Protected Resources, Permits Division) authorizing sampling, either as the permit holder, or as designated agent of the permit holder.

j. *PIT-Tag Scanning*: All sea turtles captured by relocation trawling or dredges shall be thoroughly scanned for the presence of PIT tags prior to release using a scanner powerful enough to read dual frequencies (125 and 134 kHz) and read tags deeply embedded deep in muscle tissue (e.g., manufactured by Biomark or Avid). Turtles which have been previously PIT tagged shall never-the-less be externally flipper tagged. The data collected (PIT tag scan data and external tagging data) shall be submitted to NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149. All data collected shall be submitted in electronic format within 60 working days to Lisa.Belskis@noaa.gov.

k. *CMTTP:* External flipper tag and PIT tag data generated and collected by relocation trawlers shall also be submitted to the Cooperative Marine Turtle Tagging Program (CMTTP), on the appropriate CMTTP form, at the University of Florida's Archie Carr Center for Sea Turtle Research.

l. *Tissue Sampling*: All live or dead sea turtles captured by relocation trawling or dredging shall be tissue-sampled prior to release, according to the protocols described in Appendix II or Appendix III of the November 19, 2003, Gulf of Mexico Regional Biological Opinion on Hopper Dredging, as revised through Revision No. 2, included as Appendix 1 of this opinion. Tissue samples shall be sent within 60 days of capture to: NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149. All data collected shall be submitted in electronic format within 60 working days to Lisa.Belskis@noaa.gov. The present opinion to BOEM serves as the permitting authority for any NOAA Fisheries-approved endangered species observers aboard relocation trawlers or hopper dredges to tissue-sample live- or dead-captured sea turtles, without the need for an ESA Section 10 permit.

The following terms and conditions implement the RPM for monitoring turtle interactions: In this case, in order to monitor turtle and smalltooth sawfish interactions, all interactions must be reported within 24 hours to: takereport.nmfsser@noaa.gov and must reference this opinion by date issued, title, and NMFS Public Consultation Tracking System identifier number (i.e., Dredging of Gulf of Mexico Sand Mining Areas Using Hopper Dredges by BOEM for the Town Beach Renourishment Project; F/SER/2011/01074).

10.0 Conservation Recommendations

Section 7(a)(1) of the ESA directs federal agencies to utilize their authority to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat to help implement recovery plans or to develop information. For the Town beach renourishment project, no conservation recommendations are included.

11.0 Reinitiation of Consultation

This concludes formal consultation on the Town of Longboat Key beach renourishment project, in Manatee County, Florida. 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.

12.0 Literature Cited

Ackerman, R.A. 1997. The nest environment and embryonic development of sea turtles. Pp 83-106. In: Lutz, P.L. and J.A. Musick (eds.), The Biology of Sea Turtles. CRC Press, New York. 432 pp.

Aguilar, R., J. Mas and X. Pastor. 1995. Impact of Spanish swordfish longline fisheries on the loggerhead sea turtle, *Caretta caretta*, population in the western Mediterranean, pp. 1. *In*: 12th Annual Workshop on Sea Turtle Biology and Conservation, February 25-29, 1992, Jekyll Island, Georgia.

Anders, P.J., C.R. Gelok, and M.S. Powell. 2002. Population structure and mitochondrial DNA (mtDNA) diversity in North American white sturgeon (*Acipenser transmontanus*). Proceedings of the Fourth International Sturgeon Symposium, 8-13 July 2001. Oshkosh, Wisconsin.

Antonelis, G.A., J.D. Baker, T.C. Johanos, R.C. Braun, and A.L. Harting. 2006. Hawaiian monk seal (*Monachus schauinslandi*): status and conservation issues. Atoll Research Bulletin 543:75-101.

Arendt, M., J. Byrd, A. Segars, P. Maier, J. Schwenter, D. Burgess, J. Boynton, J.D. Whitaker, L. Ligouri, L. Parker, D. Owens, and G. Blanvillain. 2009. Examination of local movement and migratory behavior of sea turtles during spring and summer along the Atlantic Coast off the Southeastern United States. Final Project Report to the National Marine Fisheries Service. Prepared by: South Carolina Department of Natural Resources. 164pp.

ASSRT. 2007. Status review of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrhincus*) Report to the National Marine Fisheries Service, Northeast Regional Office. 174pp.

Auer, N.A. 1996. Importance of habitat and migration to sturgeons with emphasis on lake sturgeon. Canadian Journal of Fisheries and Aquatic Sciences 53 (Suppl.1): 152-160.

Bain, M B. 1997. Atlantic and shortnose sturgeons of the Hudson River: common and divergent life history attributes. Environmental Biology of Fishes 48:347-358.

Bain, M.B., N. Haley, J.R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic sturgeon *Acipenser oxyrinchus* Mitchill, 1815 in the Hudson River estuary: lessons for sturgeon conservation. Bol. Inst. Esp. Oceanogr. 16:43-53.

Baker, J.D., C.L. Littnan, and D.W. Johnston. 2006. Potential effects of sea level rise on the terrestrial habitats of endangered and endemic megafauna on the Northwestern Hawaiian Islands. Endangered Species Research 2:21-30.

Baldwin, R., G.R. Hughes, and R.I.T. Prince. 2003. Loggerhead turtles in the Indian Ocean. Pages 218-232 *in* Bolten, A.B. and B.E. Witherington (editors). Loggerhead Sea Turtles. Smithsonian Books, Washington D.C.

Bath, D.W., J.M. O'Conner, J.B. Alber, and L.G. Arvidson. 1981. Development and identification of larval Atlantic sturgeon (*Acipenser oxyrinchus*) and shortnose sturgeon (*A. brevirostrum*) from the Hudson River estuary, New York. Copeia 1981: 711-717.

Bemis WE, Grande L. 1992. Early development of the actinopterygian head. I. External development and staging of the paddlefish *Polyodon spathula*. J Morphol. 213:47–83.

Berlin, W.H., R.J. Hesselberg, and M.J. Mac. 1981. Chlorinated hydrocarbons as a factor in the reproduction and survival of lake trout (*Salvelinus namaycush*) in Lake Michigan. Technical Paper 105, U.S. Fish and Wildlife Service. 42 pp.

Birstein, V.J. and W.E. Bemis. 1997. How many species are there within the genus *Acipenser?* Environmental Biology of Fishes, 48: 157–163.

Bjorndal, K.A. 1997. Foraging ecology and nutrition of sea turtles. *In*: Lutz, P.L. and J.A. Musick (eds.), The Biology of Sea Turtles. CRC Press, Boca Raton, Florida.

Blumenthal, J.M., J.L. Solomon, C.D. Bell, T.J. Austin, G. Ebanks-Petrie, M.S. Coyne, A.C. Broderick, B.J. Godley. 2006. Satellite tracking highlights the need for international cooperation in marine turtle management. Endangered Species Research 7:1-11.

Bolten, A.B., K.A. Bjorndal, and H.R. Martins. 1994. Life history model for the loggerhead sea turtle (*Caretta caretta*) populations in the Atlantic: Potential impacts of a longline fishery. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-SWFSC-201:48-55.

Bolten, A.B., J.A. Wetheral, G.H. Balazs, and S.G. Pooley (compilers). 1996. Status of marine turtles in the Pacific Ocean relevant to incidental take in the Hawaii-based pelagic longline fisheries. NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-230.

Bonsdorff , E. 1980. Macrozoobenthic recolonization of a dredged brackish water bay in SW Finland. Ophelia Suppl. 1: 145-155.

Boreman, J. 1997. Sensitivity of North American sturgeons and paddlefish to fishing mortality. Environmental Biology of Fishes 48(1-4): 399-405

Brongersma, L. 1972. European Atlantic Turtles. Zool. Verhand. Leiden, 121: 318 pp.

Buckley, J. and B. Kynard. 1981. Spawning and rearing of shortnose sturgeon from the Connecticut River. Progressive Fish Culturist 43: 74-76.

Buckley, J. and B. Kynard. 1985a. Habitat use and behavior of pre-spawning and spawning shortnose sturgeon, *Acipenser brevirostrum*, in the Connecticut River. North American Sturgeons 111-117.

Buckley, J. and B. Kynard. 1985b. Yearly movements of shortnose sturgeons in the Connecticut River. Transactions of the American Fisheries Society 114: 813-820.

Caldwell, D.K. and A. Carr. 1957. Status of the sea turtle fishery in Florida. Transactions of the 22nd North American Wildlife Conference, March 4-7, 1957, pp. 457-463.

Cameron, P., J. Berg, V. Dethlefsen, and H.V. Westernhagen. 1992. Developmental defects in pelagic embryos of several flatfish species in the southern North Sea. Netherlands Journal of Sea Research 29: 239-256.

Campbell, J.G. and L.R. Goodman. 2004. Acute sensitivity of juvenile shortnose sturgeon to low dissolved oxygen concentrations. Transactions of the American Fisheries Society 133: 772-776.

Carlson, D.M. and K.W. Simpson. 1987. Gut contents of juvenile sturgeon in the upper Hudson Estuary. Copeia 1987: 796-802.

Caron, F., D.Hatin, and R. Fortin. 2002. Biological characteristics of adult Atlantic sturgeon (*Acipenser oxyrinchus*) in the Saint Lawrence River estuary and the effectiveness of management rules. Journal of Applied Ichthyology 18:580-585.

Carr, A. 1963. Pan specific reproductive convergence in *Lepidochelys kempii*. Ergebn. Biol. 26: 298-303.

Carr, A. 1984. So Excellent a Fishe. Charles Scribner's Sons, New York.

Catesby M. 1734. The natural history of Carolina, Florida and the Bahama Islands, 1731-1734.

Chaloupka, M., K.A. Bjorndal, G.H. Balazs, A.B. Bolten, L.M. Ehrhart, C.J. Limpus, H. Suganuma, S. Troëng, and M. Yamaguchi. 2007. Encouraging outlook for recovery of a once severely exploited marine megaherbivore. Global Ecol. Biogeogr. (Published online Dec. 11, 2007; to be published in the journal in 2008).

Chapman, D. 2008. Carolina River War Has Big Ripples. Atlanta Journal Constitution. Atlanta, Georgia, August 24, 2008.

Chytalo, K. 1996. Summary of Long Island Sound dredging windows strategy workshop. In: Management of Atlantic Coastal Marine Fish Habitat: Proceedings of a workshop for habitat managers. ASMFC Habitat Management Series #2.

Clarke, D. and C.A. Miller-Way. 1992. An environmental assessment of the effects of open-water disposal of maintenance dredged material on benthic resources in Mobile Bay, Alabama. USAE Waterways Exp. Stn. MP-D-92-1.

Cobb, J.N. 1900. The sturgeon fishery of Delaware River and Bay. Report to the Commissioner, U.S. Commission of Fish and Fisheries. 25: 369-381.

Cochnauer, T.G. 1983. Abundance, distribution, growth and management of white sturgeon (*Acipenser transmontanus*) in the middle Snake River, Idaho. Ph.D. Dissertation, University of Idaho, Moscow, ID. 52 pp.

Collins, M.R. and T.I.J. Smith. 1993. Characteristics of the adult segment of the Savannah River population of shortnose sturgeon. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 47: 485-491.

Collins, M.R. and T.I.J. Smith. 1997. Management Briefs: Distributions of Shortnose and Atlantic Sturgeons in South Carolina. North American Journal of Fisheries Management 17: 995-1000.

Collins, M.R., S.G. Rogers, and T.I.J. Smith. 1996. Bycatch of sturgeons along the southern Atlantic coast of the USA. North American Journal of Fisheries Management 16: 24-29.

Collins, M.R., S.G. Rogers, T.I.J. Smith, and M.L. Moser. 2000a. Primary factors affecting sturgeon populations in the southeastern US: fishing mortality and degradation of essential habitats. Bulletin of Marine Science 66(3): 917-928.

Collins, M.R., T.I.J. Smith, W.C. Post, and O. Pashuk. 2000b. Habitat utilization and biological characteristics of adult Atlantic sturgeon in two South Carolina rivers. Transactions of the American Fisheries Society 129:982-988.

Collins, M. R., W.C. Post, and D.C. Russ. 2001. Distribution of shortnose sturgeon in the lower Savannah River. Final Report to the Georgia Ports Authority. 21 p.

Collins, M. R., W.C. Post, D.C. Russ, and T.I.J. Smith. 2002. Habitat use and movements of juvenile shortnose sturgeon in the Savannah River, Georgia-South Carolina. Transactions of the American Fisheries Society 131:975-979.

Collins, M.R., D. Cooke, B. Post, J. Crane, J. Bulak, T.I.J. Smith, T.W. Greig, and J.M. Quattro. 2003. Shortnose sturgeon in the Santee-Cooper Reservoir System, South Carolina. Transactions of the American Fisheries Society 132: 1244-1250.

Collins, M.R., C. Norwood, B. Post and A. Hazel. 2006. Shortnose and Atlantic Sturgeons: Final Report to NFWF. South Carolina Department of Natural Resources. 38 pp.

Collins, M.R., C. Norwood, and A. Rourk. 2008. Shortnose and Atlantic sturgeon age growth, status, diet, and genetics. Final Report to National Fish and Wildlife Foundation. South Carolina Department of Natural Resources, Charleston, South Carolina, 2006-0087-009. 41p.

Commission on Life Sciences (CLS). 1990. Conservation Measures, In: N. Grossblatt (eds.), Decline of the sea turtles: causes and prevention. National Academy Press, Washington D.C.

Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009. 222 pages.

Cooper, K. 1989. Effects of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans on aquatic organisms. Reviews in Aquatic Sciences 1(2): 227-242.

COSEWIC 2005. COSEWIC assessment and update status report on the shortnose sturgeon *Acipenser brevirostrum* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 27 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Counihan, T.D., J.D. DeVore, and M.J. Parsley. In press. The effect of river discharge and water temperature on the year-class strength of Columbia River white sturgeon. Transactions of the American Fisheries Society.

Craft, C., J. Clough, J. Ehmna, S. Joye, R. Park, S. Pennings, H. Guo, and M. Machmuller. 2008. Forecasting the effects of accelerated sea-level rise on tidal march ecosystem services. Frontiers in Ecology and the Environment.

Crocker, C.E. and J.J. Cech. 1997. Effects of environmental hypoxia on oxygen consumption rate and swimming activity in juvenile white sturgeon, *Acipenser transmontanus*, in relation to temperature and life intervals. Environmental Biology of Fishes 50: 382-389.

Dadswell, M.J. 1979. Biology and population characteristics of the shortnose sturgeon, *Acipenser brevirostrum* LeSueur 1818 (Osteichthyes: Acipenseridae), in the Saint John River estuary, New Brunswick, Canada. Canadian Journal of Zoology 57: 2186-2210.

Dadswell, M.J., B.D. Taubert, T.S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of biological data on shortnose sturgeon, *Acipenser brevirostrum* LeSueur, 1818. NOAA Technical Report-14. 53 pp.

Daniels, R.C., T.W. White, and K.K. Chapman. 1993. Sea-level rise: destruction of threatened and endangered species habitat in South Carolina. Environmental Management, 17(3):373-385.

DeVries, R.J. 2006. Population dynamics, movements, and spawning habitat of the shortnose sturgeon, *Acipenser brevirostrum*, in the Altamaha River. Master's Thesis, University of Georgia. 103 pp.

Dial-Cordy and Associates. 2010. Sediment survey of the lower Savannah River.

Diamond, J.M. 1984. "Normal" extinctions of isolated populations. Pp. 191-246 *In:* M.H. Nitecki (ed). Extinctions. University of Chicago Press, Chicago.

Dickerson, D., K. Reine, D. Nelson, and C. Dickerson, Jr. 1995. Assessment of sea turtle abundance in six south Atlantic U.S. channels. Miscellaneous Paper EL-95-5, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Dickerson, D.D. and J.E. Clausner. 2003. Draft: Summary of Sea Turtle/Dredging Issues and Recommended Action Tasks Generated by the Improved Draghead Design Meeting, September 4, 2003, Atlanta, Georgia. U.S. Army Corps of Engineers, Engineering Research and Development Center, Vicksburg, Mississippi. 13pp.

Dickerson, D., M. Wolters, C. Theriot, D. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Submitted for proceedings of the World Dredging Congress, Hamburg, Germany, 27 September-1 October 2004.

Dickerson, D.D, C. Theriot, M. Wolters, C. Slay, T. Bargo, W. Parks. 2007. Effectiveness of relocation trawling during hopper dredging for reducing incidental take of sea turtles. 2007 World Dredging Conference. Available at: http://el.erdc.usace.army.mil/seaturtles/docs/07-DickersonWODCON.pdf

Diffendorfer, J. 1998. Testing models of source-sink dynamics and balanced dispersal. – Oikos 81: 417–433.

Dodd, C.K. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service Biological Report, 88-14, 1988. 110 pp.

Doughty, R.W. 1984. Sea turtles in Texas: A forgotten commerce. Southwestern Historical Quarterly 88: 43-70.

Dovel, W.L., and T.J. Berggren. 1983. Atlantic sturgeon of the Hudson River estuary, New York. New York. Fish and Game Journal 30:140-172.

Dovel, W.L., A.W. Pekovitch, and T.J. Berggren. 1992. Biology of the shortnose sturgeon (*Acipenser brevirostrum* Lesueur, 1818) in the Hudson River estuary, New York. Pages 187-216 In: C.L. Smith (Ed) Estuarine Research in the 1980s. State University of New York Press, Albany, New York.

Ehrhart, L.M. 1983. Marine turtles of the Indian River lagoon system. Florida Sci. 46(3/4): 337-346.

Ehrhart, L.M. 1989. Status Report of the Loggerhead Turtle. Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham (Eds.). Proceedings of the Second Western Atlantic Turtle Symposium. NOAA Technical Memorandum NMFS-SEFSC-226, pp. 122-139.

Ehrhart, L.M., W.E. Redfoot, D.A. Bagley. 2007. Marine turtles of the central region of the Indian River Lagoon system. Florida Scientist 70(4): 415-434.

Epperly, S.P. and W.G. Teas. 2002. Turtle excluder devices: Are the escape openings large enough? Fish Bull. 100: 466-474.

Epperly, S.P., J. Braun, and A.J. Chester. 1995a. Aerial surveys for sea turtles in North Carolina inshore waters. Fishery Bulletin 93: 254-261.

Epperly, S.P., J. Braun, and A. Veishlow. 1995b. Sea turtles in North Carolina waters. Conserv. Biol. 9: 384-394.

Epperly, S.P., J. Braun, A. J. Chester, F.A. Cross, J. Merriner, and P.A. Tester. 1995c. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. Bull. Mar. Sci. 56(2): 519-540.

Epperly, S., L. Avens, L. Garrison, T. Henwood, W. Hoggard, J. Mitchell, J. Nance, J. Poffenberger, C. Sasso, E. Scott-Denton, and C. Yeung. 2002. Analysis of sea turtle bycatch in the commercial shrimp industry of southeast U.S. waters and the Gulf of Mexico. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-490. 88 pp.

Epperly, S.P., J. Braun-McNeill, P.M. Richards. 2007. Trends in the catch rates of sea turtles in North Carolina, U.S.A. Endangered Species Research. 3: 283-293.

Erickson, D.L., J.A. North, J.E. Hightower, J. Weber, and L. Lauck. 2002. Movement and habitat use of green sturgeon *Acipenser medirostris* in the Rogue River, Oregon, U.S.A. Journal of Applied Ichthyology 18:565.569.

Evermann, B.W. and B.A. Bean. 1898. Indian River and its fishes. Report of the United States Fisheries Commission 1896: 227-248.

Fish, M.R., I.M. Cote, J.A. Gill, A.P. Jones, S. Renshoff, and A.R. Watkinson. 2005. Predicting the impact of sea-level rise on Caribbean sea turtle nesting habitat. Conservation Biology, 19(2):482-491.

Flournoy, P.H., S.G. Rogers, and P.S. Crawford. 1992. Restoration of shortnose sturgeon in the Altamaha River, Georgia. Final Report to the United States Fish and Wildlife Service. 29 pp.

Frazer, N.B. and L.M. Ehrhart. 1985. Preliminary growth models for green, *Chelonia mydas*, and loggerhead, *Caretta caretta*, turtles in the wild. Copeia 1985: 73-79.

Frazer, N.B., C.J. Limpus, and J.L. Greene. 1994. Growth and age at maturity of Queensland loggerheads. U.S. Department of Commerce. NOAA Technical Memorandum, NMFS-SEFSC-351: 42-45.

Garduño-Andrade, M., V. Guzman, E. Miranda, R. Briseno-Duenas, and F.A. Abreu-Grobois. 1999. Increases in hawksbill turtle (*Eretmochelys imbricata*) nestings in the Yucatan Peninsula, Mexico, 1977-1996: data in support of successful conservation? Chelonian Conservation and Biology 3(2): 286-295.

Giesy, J.P., J. Newsted, and D.L. Garling. 1986. Relationships between chlorinated hydrocarbon concentrations and rearing mortality of chinook salmon (*Oncorhynchus tshawytscha*) eggs from Lake Michigan. Journal of Great Lakes Research 12(1): 82-98.

Gilbert, C.R. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic Bight): Atlantic and shortnose sturgeons. United States Fish and Wildlife Service Biological Report-Report Number-82 (11.91).

Gladys Porter Zoo. 2007. Report on the Mexico/United States of America Population Restoration Project for the Kemp's Ridley Sea Turtle, Lepidocheyls kempii, on the coasts of Tamaulipas and Veracruz, Mexico – 2007. Report submitted to the U.S. Fish and Wildlife Service, Department of Interior.

Gladys Porter Zoo. 2008. Final Report on the Mexico/United States of America Population Restoration Project for the Kemp's Ridley Sea Turtle, *Lepidochelys kempii*, on the Coasts of Tamaulipas, Mexico. Report presented by Dr. Patrick M. Burchfield and prepared by Luis Jaime Pena- Gladys Porter Zoo, Brownsville, Texas.

Gladys Porter Zoo. 2010. Summary Final Report on the Mexico/United States of America Population Restoration Project for the Kemp's Ridley Sea Turtle, *Lepidochelys kempii*, on the Coasts of Tamaulipas, Mexico. Report presented by Dr. Patrick M. Burchfield and prepared by Luis Jaime Pena- Gladys Porter Zoo, Brownsville, Texas.

Greene, K.E., J.L. Zimmerman, R.W. Laney, and J.C. Thomas-Blate. 2009. Atlantic coast diadromous fish habitat: A review of utlization, threats, recommendations for conservation, and research needs. Atlantic States Marine Fisheries Commission Habitat Management Series No. 9. Washingotn, D.C.

Groombridge, B. 1982. The IUCN Amphibia - Reptilia Red Data Book. Part 1. Testudines, Crocodylia, Rhynchocephalia. Int. Union Conserv. Nature and Nat. Res., 426pp.

Gross, M.R., J. Repka, C.T. Robertson, D.H. Secor, and W.V. Winkle. 2002. Sturgeon conservation: insights from elasticity analysis. Pages 13-30 In: V.W. Webster et al. (eds.). Biology, management, and protection of North American sturgeon, Symposium 28. American Fisheries Society, Bethesda, Maryland.

Grunwald, C., J. Stabile, J. R. Waldman, R.Gross, and I. Wirgin. 2002. Population genetics of shortnose sturgeon *Acipenser brevirostrum* based on mitochondrial DNA control region sequences. Molec. Ecol. 11:1885-1898.

Grunwald, C., L. Maceda, J. Waldman, J. Stabile, I. Wirgin. 2007. Conservation of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus*: delineation of stock structure and distinct population segments. Conserv. Genet 9:1111–1124.

Guseman, J.L. and L.M. Ehrhart. 1992. Ecological geography of Western Atlantic loggerheads and green turtles: evidence from remote tag recoveries. *In* Salmon M. and J. Wyneken (compilers), Proceedings of the Eleventh Annual Workshop on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFC-302. 50 pp.

Hall, J.W., T.I.J. Smith, and S.D. Lamprecht. 1991. Movements and habitats of shortnose sturgeon, *Acipenser brevirostrum*, in the Savannah River. Copeia 1991(3): 695-702.

Hansen, P.D. 1985. Chlorinated hydrocarbons and hatching success in Baltic herring spring spawners. Marine Environmental Research 15: 59-76.

Hanski, I. 1999. Old and new challenges. Pp. 264-265 in: Metapopulation Ecology (I. Hanski, ed.). Oxford University Press, Oxford.

Hanski, I., and D. Simberloff. 1997. The metapopulation approach, its history, conceptual domain, and application to conservation. Pp. 5-26 in: Metapopulation Biology: Ecology, Genetics and Evolution (I. Hanski and M.E. Gilpin, eds.). Academic Press, New York.

Hardy, R.S. and M.K. Litvak. 2004. Effects of temperature on the early development, growth, and survival of shortnose sturgeon, *Acipenser brevirostrum*, and Atlantic sturgeon, *Acipenser oxyrinchus*, yolk-sac larvae. Environmental Biology of Fishes 70: 145-154.

Harrison, S. 1991. Local extinction in a metapopulation context: an empirical evaluation. Biological Journal of the Linnean Society 42:73-88.

Hatase, H., M. Kinoshita, T. Bando, N. Kamezaki, K. Sato, Y. Matsuzawa, K. Goto, K. Omuta, Y. Nakashima, H. Takeshita, and W. Sakamoto. 2002. Population structure of loggerhead turtles, *Caretta caretta*, nesting in Japan: Bottlenecks on the Pacific population. Marine Biology 141:299-305.

Hawkes, L.A., A.C. Broderick, M.S. Coyne, M.H. Godfrey, L.-F. Lopez-Jurado, P. Lopez-Suarez, S.E. Merino, N. Varo-Cruz, and B.J. Godley. 2006. Phenotypically linked dichotomy in sea turtle foraging requires multiple conservation approaches. Current Biology 16: 990-995.

Hawkes, L.A., A.C. Broderick, M.H.Godfrey, and B.J. Godley. 2007. Investigating the potential impacts of climate change on a marine turtle population. Global Change Biology, 13:923-932.

Hays, G.C., A.C. Broderick, F. Glen, B.J. Godley, J.D.R. Houghton, and J.D. Metcalfe. 2002. Water temperature and internesting intervals for loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles. Journal of Thermal Biology, 27:429-432.

Heidt, A.R. and R.J. Gilbert. 1978. The shortnose sturgeon in the Altamaha River drainage. Pp 54-60 In: R.R. Odum and L. Landers (eds.) Proceedings of the rare and endangered wildlife symposium. Georgia Department of Natural Resources, Game and Fish Division.

Henwood, T.A. and L.H. Ogren. 1987. Distribution and migrations of immature Kemp's ridley (*Lepidochelys kempii*) and green turtles (*Chelonia mydas*) off Florida, Georgia, and South Carolina. Northeast Gulf Sci. 9: 153-159.

Heppell, S.S., L.B. Crowder, D.T. Crouse, S.P. Epperly, and N.B. Frazer. 2003. Population models for Atlantic loggerheads: past, present, and future. *In*: Loggerhead Sea Turtles. Bolten, A.B. and B.E. Witherington (eds.). Smithsonian Books, Washington. pp 255-273.

Hildebrand, H.H. 1963. Hallazgo del area de anidacion de la tortuga marina "lora" *Lepidochelys kempii* (Garman), en la costa occidental del Golfo de Mexico. Ciencia Mexicana 22(4): 105-112.

Hildebrand, H.H. 1982. A historical review of the status of sea turtle populations in the Western Gulf of Mexico. In Bjorndal, K.A. (ed.), Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington D.C. pp 447-453.

Hill, J. 1996. Environmental considerations in licensing hydropower projects; policies and practices of the Federal Energy Regulatory Commission. American Fisheries Society Symposium 16: 190-199.

Hirth, H.F. 1997. Synopsis of the biological data on the green turtle *Chelonia mydas* (Linnaeus 1758). Biological Report 97(1), U.S. Fish and Wildlife Service, U.S. Dept. of the Interior. 120 pp.

Hoff, T.B., R.J. Klauda and J.R. Young. 1988. Contribution to the biology of shortnose sturgeon in the Hudson River Estuary. Pp 171-189 In: C.L. Smith (ed.) Fisheries Research in the Hudson River. Hudson River Environmental Society. State University of New York press, Albany, New York.

Huff, J.A. 1975. Life history of Gulf of Mexico sturgeon, *Acipenser oxyrinchus desotoi*, in Suwannee River, Florida. Florida Department of Natural Resources, Marine Research Publication 16, St. Petersburg, FL.

Hulme, P.E. 2005. Adapting to climate change: is there scope for ecological management in the face of global threat? Journal of Applied Ecology 43: 617-627.

IPCC (Intergovernmental Panel on Climate Change). 2007. Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Quin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds)] Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Jager, H.I., W. VanWinkle, J.A. Chandler, K.B. Lepla, P. Bates, and T.D. Counihan. 2002. A simulation study of factors controlling white sturgeon recruitment in the Snake River. American Fisheries Society Symposium 28: 127-150.

Jarvis, P. L., J. S. Ballantyne, and W. E. Hogans. 2001. The influence of salinity on the growth of juvenile shortnose sturgeon. North American Journal of Aquaculture 63:272-276.

Jenkins, W.E., T.I.J.Smith, L.D. Heyward, and D.M. Knott. 1993. Tolerance of shortnose sturgeon, *Acipenser brevirostrum*, juveniles to different salinity and dissolved oxygen concentrations. Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies 47: 476-484.

Jensen, A. and G. Silber. 2003. Large Whale Ship Strike Database. U.S. Department of Commerce, NOAA Technical Memorandum. NMFS-F/OPR-25, 37 pp.

Johnson, S.A. and L.M. Ehrhart. 1994. Nest-site fidelity of the Florida green turtle. *In* Schroeder, B.A. and B.E. Witherington (compilers), Proceedings of the Thirteenth Annual Symposium on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-341. 83 pp.

Kahn, J. and M. Mohead. 2010. A Protocol for Use of Shortnose, Atlantic, Gulf, and Green Sturgeons. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-OPR-45, 62 p.

Kahnle, A.W., K.A. Hattala, K.A. McKown, C.A. Shirey, M.R. Collins, T.S. Squiers, Jr., and T. Savoy. 1998. Stock Status of Atlantic sturgeon of Atlantic Coast Estuaries. Report for the Atlantic States Marine Fisheries Commission. Draft III.

Kaplan, E.H., J.R. Welker, M.G. Kraus, and S. McCourt. 1975. Some factors affecting the colonization of a dredged channel. Marine Biology 32,193e204.

Keinath, J.A., J.A. Musick and R.A. Byles. 1987. Aspects of the biology of Virginia's sea turtles: 1979-1986. Virginia J. Sci. 38(4):329-336.

Keiser, R.K. 1976. Species composition, magnitude and utilization of the incidental catch of the South Carolina shrimp fishery. S.C. Mar. Resour. Cent. Tech. Rep. 16, 94 p.

Kieffer, M.C. and B. Kynard. 1993. Annual movements of shortnose and Atlantic sturgeons in the Merrimack River, Massachusetts. Transactions of the American Fisheries Society 122: 1088-1103.

Kieffer, M. and B. Kynard. 1996. Spawning of shortnose sturgeon in the Merrimack River, Massachusetts. Transactions of the American Fisheries Society 125: 179-186.

Kindvall, O. and I. Ahlen. 1992. Geometrical factors and metapopulation dynamics of the brush cricket, *Metrioptera bicolor* Phillippi (Orthoptera: Tettigoniidae). Conservation Biology 6: 520-529.

King, T. L., B. A. Lubinski, and A. P. Spidle. 2001. Microsatellite DNA variation in Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) and cross-species amplification in the Acipenseridae. Conservation Genetics 2: 103-119.

King, T.L., A.P Henderson, B.E. Kynard, M.C. Kiefer, D.L. Peterson and D.S. Pavek. In prep. A nuclear DNA perspective on delineating fundamental units of management and distinct population segments in the endangered shortnose sturgeon. Final Report to the National Capital Region, U.S. National Park Service and Eastern Region, USGS.

Kite-Powell, H.K., A. Knowlton, and M. Brown. 2007. Modeling the effect of vessel speed on right whale ship strike risk. Project report for NOAA/NMFS Project NA04NMF47202394. April 2007.

Knowlton, A.R. and S.D. Kraus. 2001. Mortality and serious injury of northern right whales (Eubalaena glacialis) in the western North Atlantic Ocean. Journal of Cetacean Research and Management (Special Issue) 2:193-208.

Kynard, B. 1997. Life history, latitudinal patterns and status of shortnose sturgeon, *Acipenser brevirostrum*. Environmental Biology of Fishes 48: 319-334.

Kynard, B. 1998. Twenty-two years of passing shortnose sturgeon in fish lifts on the Connecticut River: What has been learned? In: Fish migration and fish bypasses, M. Jungwirth, S. Schmutz, and S. Weiss, Editors. pp. 255-264.

Kynard, B. and M. Horgan. 2002. Ontogenetic behavior and migration of Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*, and shortnose sturgeon, *A. brevirostrum*, with notes on social behavior. Environmental Behavior of Fishes 63: 137-150.

Kynard, B., M. Kieffer, M. Burlingame and M. Horgan. 1999. Studies on shortnose sturgeon. Final Report to Northeast Utilities Service Company, Berlin, Connecticut and the City of Holyoke, Massachusetts.

Kynard, B., M. Horgan, M. Kieffer, and D. Seibel. 2000. Habitats used by shortnose sturgeon in two Massachusetts rivers, with notes on estuarine Atlantic sturgeon: a hierarchical approach. Transactions of the American Fisheries Society 129: 487-503.

Laist, D.W. and C. Shaw. 2006. Preliminary evidence that boat speed restrictions reduce deaths of Florida manatees. Marine Mammal Science 22(2):472-479.

Laist, D.W., A.R. Knowlton, J.G. Mead, A.S. Collet, and M. Podesta. 2001. Collisions between ships and whales. Marine Mammal Science 17(1):35-75.

Lande, R. 1988. Genetics and demography in biological conservation. Science 241: 1455-1460.

Laurent, L., P. Casale, M.N. Bradai, B.J. Godley, G. Gerosa, A.C. Broderick, W. Schroth, B. Schierwater, A.M. Levy, D. Freggi, E.M. Abd El-Mawla, D.A. Hadoud, H.E. Gomati, M. Domingo, M. Hadjichristophorou, L. Kornaraki, F. Demirayak, and C. Gautier. 1998. Molecular resolution of the marine turtle stock composition in fishery bycatch: A case study in the Mediterranean. Molecular Ecology 7:1529-1542.

León, Y.M. and C.E. Diez, 2000. Ecology and population biology of hawksbill turtles at a Caribbean feeding ground (Proceedings of the Eighteenth International Sea Turtle Symposium. U.S. Dept. of Commerce. NOAA Technical Memorandum NMFS-SEFSC-436, 293 pp.; 2000, p. 32-33)

Levins, R. 1969. Some demographic and genetic consequence of environmental heterogeneity for biological control. Bulletin of the Entomological Society of America. 15: 237-240.

Limpus, C.J. and D.J. Limpus. 2003. Loggerhead turtles in the equatorial Pacific and southern Pacific Ocean: A species in decline. *In*: Bolten, A.B., and B.E. Witherington (eds.), Loggerhead Sea Turtles. Smithsonian Institution.

Longwell, A.C., S. Chang, A. Hebert, J. Hughes, and D. Perry. 1992. Pollution and developmental abnormalities of Atlantic fishes. Environmental Biology of Fishes 35: 1-21.

Lutcavage, M. and J.A. Musick. 1985. Aspects of the biology of sea turtles in Virginia. Copeia (1985): 449-456.

Mac, M.J. and C.C. Edsall. 1991. Environmental contaminants and the reproductive success of lake trout in the Great Lakes: An epidemiological approach. Journal of Toxicology and Environmental Health 33: 375-394.

Mangin, E. 1964. Croissance en Longueur de Trois Esturgeons d'Amerique du Nord: *Acipenser oxyrhynchus*, Mitchill, *Acipenser fulvescens*, Rafinesque, et *Acipenser brevirostris* LeSueur. Verh. Int. Ver. Limnology 15: 968-974.

Marchette, D.E. and R. Smiley. 1982. Biology and life history of incidentally captured shortnose sturgeon, *Acipenser brevirostrum*, in South Carolina. South Carolina Wildlife and Marine Resources. Unpublished MS.

Margaritoulis, D., R. Argano, I. Baran, F. Bentivegna, M.N. Bradai, J.A. Camiñas, P. Casale, G.De Metrio, A. Demetropoulos, G. Gerosa, B.J. Godley, D.A. Haddoud, J. Houghton, L.Laurent, and B. Lazar. 2003. Loggerhead turtles in the Mediterranean Sea: present knowledge and conservation perspectives. Pages 175-198 *in* Bolten, A.B. and B.E.Witherington (editors). Loggerhead Sea Turtles. Smithsonian Books, Washington D.C.

Márquez, R. 1990. FAO Species Catalogue, Vol. 11. Sea turtles of the world, an annotated and illustrated catalogue of sea turtle species known to date. FAO Fisheries Synopsis, 125. 81 pp.

McCleave, J.D., S.M. Fried, and A.K. Towt. 1977. Daily movements of shortnose sturgeon, *Acipenser brevirostrum*, in a Maine estuary. Copeia 1977: 149-157.

McCord, J.W. 1998. Investigation of fisheries parameters for anadromous fisheries in South Carolina. South Carolina Department of Natural Resources. Completion report to National Marine Fisheries Service (AFC -53).

McClellan, C.M. and A.J. Read. 2007. Complexity and variation in loggerhead sea turtle life history. Biology Letters 3:592-594.

McDonald, M. 1887. The rivers and sound of North Carolina. Pp 625-637 *In:* G.B. Goode (ed.) The fisheries and fishery industries of the United States, Section V, Volume 1. U.S. Commission on Fish and Fisheries, Washington D.C.

McElhaney, P., M.H. Rucklelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionary significant units. U.S. Dept. Commer. NOAA Tech Memo. NMFS-NWFSC-42. 156 p.

McMaster, H. 2007. South Carolina Attorney General's Office, Current Cases, State of South Carolina vs. State of North Carolina Water War. November 13, 2008. http://www.scattorneygeneral.org/currentcases/waterwar.html

Mendonca, M.T., and L.M. Ehrhart. 1982. Activity, Population Size and Structure of Immature *Chelonia mydas* and *Caretta caretta* in Mosquito Lagoon, Florida. Copeia 1:161-167.

Meylan, A. 1999. Status of the Hawksbill Turtle (*Eretmochelys imbricata*) in the Caribbean Region. Chelonian Conservation and Biology 3(2): 177B184. Available at (http://www.iucn-mtsg.org/publications/cc&b_april1999/4.14-Meylan-Status.pdf).

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the state of Florida. Florida Marine Research Publications, No. 52

Milton, S.L., S. Leone-Kabler, A.A. Schulman, and P.L. Lutz. 1994. Effects of Hurricane Andrew on the sea turtle nesting beaches of South Florida. Bulletin of Marine Science, 54(3): 974-981.

Milton, S.L., Lutz , P.L. 2003 Physiological and genetic responses to environmental stress. *In*: Lutz PL, Musick JA, Wyneken J (eds) The biology of sea turtles, Vol II. CRC Press, Boca Raton, FL, p 163–197

Moorehead, K.K. and M.M. Brinson. 1995. Response of wetlands to rising sea level in the lower coast plain of North Carolina. Ecological Applications 5: 261-271.

Moser, M. L. and S. W. Ross. 1993. Distribution and movements of shortnose sturgeon (*Acipenser brevirostrum*) and other anadromous fishes of the lower Cape Fear River, North Carolina. Final Report to the U.S. Army Corps of Engineers, Wilmington, North Carolina.

Moser, M.L. and S.W. Ross. 1995. Habitat use and movements of shortnose and Atlantic sturgeons in the Lower Cape Fear River, North Carolina. Transactions of the American Fisheries Society 124: 225-234.

Moser M. L., J. B. Bichy, and S. B. Roberts. 1998. Sturgeon distribution in North Carolina. Center for Marine Science Research. Final Report to U.S. ACOE, Wilmington District, NC.

Moser, M.L., M. Bain, M.R. Collins, N. Haley, B. Kynard, J.C. O'Herron II, G. Rogers, and T.S. Squiers. 2000. A Protocol for Use of Shortnose and Atlantic Sturgeons. U.S. Department of Commerce, NOAA Technical Memorandum-NMFS-OPR-18. 18 pp.

Munro, J., R.E. Edwards, and A.W. Kahnle. 2007. Anadromous sturgeons: habitats, threats, and management. American Fishereis Society Symposium 56: 1-15.

Murawski, S.A. and A.L. Pacheco. 1977. Biological and fisheries data on Atlantic sturgeon, *Acipenser oxyrhynchus* (Mitchill). National Marine Fisheries Service, Sandy Hool Lab., Sandy Hook. Tech. Report No. 10. 78 pp.

Murdoch, P.S., J.S. Baron and T.L. Miller. 2000. Potential effects of climate change on surface-water quality in North America. Journal of the American Water Resources Association 36: 347-366.

Murphy, T.M. and S.R. Hopkins. 1984. Aerial and ground surveys of marine turtle nesting beaches in the Southeast region, U.S. Final Report to the National Marine Fisheries Service; NMFS Contract No. NA83-GA-C-00021. 73 pp.

Musick, J.A. 1999. Ecology and conservation of long-lived marine animals. Pp 1-10 In: J.A. Musick (ed.) Life in the slow land: ecology and conservation of long-lived marine animals. American Fisheries Society Symposium 23, Bethesda, Maryland.

Musick, J.A. and C.J. Limpus. 1997. Habitat utilization in juvenile sea turtles. *In* Lutz, P.L. and J.A. Musick (eds.), The Biology of Sea Turtles. CRC Press, Boca Raton, Florida. pp. 137-163.

NAST (National Assessment Synthesis Team). 2000. Climate change impacts on the United States: the potential consequences of climate variability and change. US Global Change Research Program, Washington D.C.

Niklitschek, E.J. 2001. Bioenergetics modeling and assessment of suitable habitat for juvenile Atlantic and shortnose sturgeons (*Acipenser oxyrinchus* and *A. brevirostrum*) in the Chesapeake Bay [dissertation]. [College Park(MD)]: University of Maryland.

Niklitschek, E.J. and D.H. Secor. 2005. Modeling spatial and temporal variation of suitable nursery habitats for Atlantic sturgeon in the Chesapeake Bay. Estuarine, Coastal and Shelf Science 64:135–148.

NIDIS (National Integrated Drought Information System). 2008. Current Drought Conditions for the State of Georgia, November 4, 2008. http://www.drought.gov/portal/server.pt?uuID=%7B950C0A74-978E-47AF-2FF0-9159361A2000%7D&mode=2&in_hi_userid=2&state=GA

NMFS. 1991. Biological Opinion for the Dredging of channels in the Southeastern United States from North Carolina through Cape Canaveral, Florida.

NMFS. 1995. Endangered Species Act section 7 consultation on United States Coast Guard vessel and aircraft activities along the Atlantic coast. Biological Opinion. September 15.

NMFS. 1996. Endangered Species Act section 7 consultation on reinitiation of consultation on United States Coast Guard Vessel and Aircraft Activities along the Atlantic Coast. Biological Opinion. July 22.

NMFS. 1997a. Endangered Species Act section 7 consultation on Navy activities off the southeastern United States along the Atlantic Coast. Biological Opinion. May 15.

NMFS. 1997b. Endangered Species Act section 7 consultation on the continued hopper dredging of channels and borrow areas in the southeastern United States. Biological Opinion. September 25.

NMFS. 1998. Endangered Species Act section 7 consultation on COE permits to Kerr-McGee Oil and Gas Corporation for explosive rig removals off of Plaquemines Parish, Louisiana. Draft Biological Opinion. September 22.

NMFS. 1998. Recovery plan for the shortnose surgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team. 119 pp.

NMFS. 2001a. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. U.S. Department of Commerce NOAA Technical Memorandum NMFS-SEFSC-455.

NMFS. 2001b. Endangered Species Act section 7 consultation on the reinitiation of consultation on the Atlantic highly migratory species fishery management plan and its associated fisheries. Biological Opinion. June 14.

NMFS. 2002. Endangered Species Act section 7 consultation on shrimp trawling in the southeastern United States under the sea turtle conservation regulations and as managed by the fishery management plans for shrimp in the South Atlantic and the Gulf of Mexico. Biological Opinion, December 2.

NMFS. 2003. Endangered Species Act section 7 consultation on the continued operation of Atlantic shark fisheries (commercial shark bottom longline and drift gillnet fisheries and recreational shark fisheries) under the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (HMS FMP) and the Proposed Rule for Draft Amendment 1 to the HMS FMP. Biological Opinion. July 2003.

NMFS. 2004a. Endangered Species Act section 7 consultation on proposed regulatory amendments to the FMP for the pelagic fisheries of the western Pacific region. Biological opinion. February 23.

NMFS. 2004b. Endangered Species Act section 7 reinitiation consultation on the Atlantic pelagic longline fishery for highly migratory species. Biological Opinion. June 1.

NMFS. 2007. Endangered Species Act section 7 consultation on the dredging of Gulf of Mexico navigation channels and sand mining ("borrow") areas using hopper dredges by COE Galveston, New Orleans, Mobile, and Jacksonville Districts. Revised Biological Opinion (November 2003). January 2007.

NMFS SEFSC (Southeast Fisheries Science Center). 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. U.S.

Department of Commerce, National Marine Fisheries Service, Miami, Florida, SEFSC Contribution PRD-00/01-08; Parts I-III and Appendices I-V1.

NMFS-SEFSC. 2009. Estimated impacts of mortality reductions on loggerhead sea turtle population dynamics, preliminary results. Presented at the meeting of the Reef Fish Management Committee of the Gulf of Mexico Fishery Management Council, June 16, 2009, Tampa, Florida, 20p. (Posted 6/2009 at http://www.sefsc.noaa.gov/seaturtleabstracts.jsp)

NMFS and USFWS. 1991a. Recovery Plan for U.S. Population of Atlantic Green Turtle. National Marine Fisheries Service, Washington, D.C.

NMFS and USFWS. 1991b. Recovery Plan for U.S. Population of Loggerhead Turtle. National Marine Fisheries Service, Washington, D.C.

NMFS and USFWS. 1993. Recovery Plan for Hawksbill Turtles in the U.S. Caribbean Sea, Atlantic Ocean, and Gulf of Mexico. National Marine Fisheries Service, St. Petersburg, Florida.

NMFS and USFWS. 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. National Marine Fisheries Service, Silver Spring, Maryland.

NMFS and USFWS. 1998a. Recovery Plan for U.S. Pacific Populations of the Green Turtle. Prepared by the Pacific Sea Turtle Recovery Team.

NMFS and USFWS. 1998b. Recovery Plan for U.S. Pacific Populations of the Hawksbill Turtle (*Eretmochelys imbricata*). National Marine Fisheries Service, Silver Spring, Maryland.

NMFS and USFWS. 1998c. Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle. Prepared by the Pacific Sea Turtle Recovery Team.

NMFS and USFWS. 1998d. Recovery Plan for U.S. Pacific Populations of the Loggerhead Turtle. Prepared by the Pacific Sea Turtle Recovery Team.

NMFS and USFWS. 2007a. Loggerhead Sea Turtle (*Caretta caretta*) 5-Year Review: Summary and Evaluation.

NMFS and USFWS. 2007b. Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) 5-Year Review: Summary and Evaluation.

NMFS and USFWS. 2007c. Green Sea Turtle (*Chelonia mydas*) 5-Year Review: Summary and Evaluation.

NMFS and USFWS. 2007d. Leatherback sea turtle (Dermochelys coriacea) 5 year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland. 79 pp.

NMFS and USFWS. 2007e. Loggerhead sea turtle (Caretta caretta) 5 year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland. 65 pp.

NMFS and USFWS. 2008. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*), Second Revision. National Marine Fisheries Service, Silver Spring, MD.

NMFS, USFWS, and SEMARNAT. 2011. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. National Marine Fisheries Service. Silver Spring, Maryland 156 pp. + appendices

NRC (National Research Council, Committee on Sea Turtle Conservation). 1990. Decline of the Sea Turtles: Causes and Prevention. National Academy Press, Washington D.C.

Ogren, L.H. 1989. Distribution of juvenile and subadult Kemp's Ridley Sea Turtles: Preliminary Results from the 1984-1987 Surveys. *In* Caillouet, C.W., Jr. and A.M. Landry, Jr. (eds.), Proceedings of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management. Texas A&M University Sea Grant College Program, Galveston. TAMU-SG-89-105

O'Herron, J.C., K.W. Able, and R.W. Hastings. 1993. Movements of shortnose sturgeon (*Acipenser brevirostrum*) in the Delaware River. Estuaries 16:235-240.

Ong, T.L., J. Stabile, I. Wirgin, and J.R.Waldman. 1996. Genetic divergence between *Acipenser oxyrhinchus oxyrhinchus* and *A. o. desotoi:* An assessment by mitochondrial DNA analysis Copeia 2: 464–469.

Pace, R.M. and G.K. Silber. 2005. Abstract. Simple analyses of ship and large whale collisions: Does speed kill? Sixteenth Biennial Conference on the Biology of Marine Mammals, San Diego, December 2005.

Palmer, M.A., C.A. Reidy Liermann, C. Nilsson, M. Florke, J. Alcama, P.S. Lake and N. bond. 2008. Climate change and the world's river basins: anticipating management options. Frontiers in Ecology and the Environment 6: 81-89.

Panigada, S., G. Pesante, M. Zanardelli, F. Capoulade, A. Gannier, and M.T. Weinrich. 2006. Mediterranean whales at risk from fatal ship strikes. Marine Pollution Bulletin 52, 1287–1298.

Paragamian, V.L. and J.P. Duehr. 2005. Variation in vertical location of Kootenai River white sturgeon during the prespawn and spawning periods. Trans. Am. Fish. Soc. 134 (1):261-266.

Paragamian, V.L., and G. Kruse. 2001. Kootenai River white sturgeon spawning migration behavior and a predictive model. North American Journal of Fisheries Management 21:22-33.

Park, R.A., J.K. Lee, P.W. Mausel, and R.C. Howe. 1991. The effects if sea level rise on US coastal wetlands. In: J.B. Smith and D.A. Tirpak (eds), The potential effects of global climate change on the United States. Appendix B – sea-level rise. Washington DC: US Environmental Protection Agency.

Peterson, D.L., P. Vecsei, C.A. Jennings. 2006. Ecology and biology of the lake sturgeon: a synthesis of current knowledge of a threatened North American *Acipenseridae*. Rev. Fish Biol. Fisheries 17:59–76.

Pike, D.A., R.L. Antworth, and J.C. Stiner. 2006. Earlier nesting contributes to shorter nesting seasons for the Loggerhead sea turtle, *Caretta caretta*. Journal of Herpetology, 40(1):91-94.

Poddubny, S.P. and D.L. Galat. 1995. Habitat associations of Upper Volga River fishes: effects of reservoirs. Regulated Rivers: Research and Management 11: 67-84.

Pottle, R., and M.J. Dadswell. 1979. Studies on larval and juvenile shortnose sturgeon (*Acipenser brevirostrum*). Report to the Northeast Utilities Service Company, Hartford, Connecticut.

Pritchard, P.C.H. 1969. Sea turtles of the Guianas. Bull. Fla. State Mus. 13(2): 1-139.

Pritchard, P.C.H. 1997. Evolution, phylogeny, and current status. *In*: Lutz, P.L. and J.A. Musick (ed). The Biology of Sea Turtles. pp 1-28. CRC Press. Boca Raton, Florida.

Quattro, J.M., T.W. Greig, D.K. Coykendall, B.W. Bowen, and J.D. Baldwin. 2002. Genetic issues in aquatic species management: the shortnose sturgeon (*Acipenser brevirostrum*) in the southeastern United States. Conservation Genetics 3: 155-166.

Ray, G. 1997. Benthic Assemblages of the Padilla Bay National Estuarine Research. Reserve, Mount Vemon, Washington. Washington State Department of Ecology Publication No., Padilla Bay National Estuarine Research Reserve Technical Report No. 21, Mount Vernon, Washington. 91pp.

Renaud, M.L. 1995. Movements and submergence patterns of Kemp's ridley turtles (*Lepidochelys kempii*). Journal of Herpetology 29: 370-374.

Richmond, A. and B. Kynard. 1995. Ontogenetic behavior of shortnose sturgeon. Copeia 1995: 172-182.

Rogers, S.G. and W. Weber. 1994. Occurrence of shortnose sturgeon (*Acipenser brevirostrum*) in the Ogeechee-Canoochee river system, Georgia, during the summer of 1993. Final Report of the United States Army to the Nature Conservancy of Georgia.

Rogers, S.G. and W. Weber. 1995. Status and restoration of Atlantic and shortnose sturgeons in Georgia. Final Report to the National Marine Fisheries Service, Southeast Regional Office, St. Petersburg, Florida.

Rogers, S.G., P.H. Flourney, and W. Weber. 1994. Status and restoration of Atlantic sturgeon in Georgia. Final report to the National Marine Fisheries Service Project NA46F0098-01, -02, -03.

Rosenthal, H. and D.F. Alderdice. 1976. Sublethal effects of environmental stressors, natural and pollutional, on marine fish eggs and larvae. Journal of the Fisheries Research Board of Canada 33: 2047-2065.

Ross, J.P. 1979. Historical decline of loggerhead, ridley, and leatherback sea turtles. *In*: Bjorndal, K.A. (editor), Biology and Conservation of Sea Turtles. pp. 189-195. Smithsonian Institution Press, Washington, D.C. 1995.

Ruelle, R. and K.D. Keenlyne. 1993. Contaminants in Missouri River Pallid Sturgeon. Bulletin of Environmental Contamination and Toxicology 50: 898-906.

Rusert, W., and R. Cummings. 2004. Characteristics of Water-use Control Policies: A Survey of 28 Eastern States. Water Policy Working Paper #2004-001. North Georgia Water Planning and Policy Center, Andrew Young School of Policy Studies, Georgia State University, Atlanta, Georgia, February 2004.

Sæther, B.E., S. Engen, A. Islam, R. McCleery, and C. Perrins. (1998) Environmental stochasticity and extinction risk in a population of a small song bird, the great tit. American Naturalist, 151, 441–450.

Savoy, T. 1991. Sturgeon status in Connecticut Waters. Connecticut Department of Environmental Protection. 43 pp.

SCDNR. 2008. Loggerheadlines. July-December 2008.

Schlosser, I.J. and P.L. Angermeier. 1995. Spatial variations in demographic processes of lotic fishes: conceptual models, empirical evidence, and implications for conservation. Pp 392-401 In: J.L. Nielsen (ed.) Evolution and the Aquatic Ecosystem: Defining Unique Unites in Population Conservation. American Fisheries Society. Bethesda, MD.

Schmid, J.R. and W.N. Witzell. 1997. Age and growth of wild Kemp's ridley turtles (*Lepidochelys kempii*): Cumulative results of tagging studies in Florida. Chelonian Conservation and Biology 2: 532-537.

Schroeder, B.A., and A.M. Foley. 1995. Population studies of marine turtles in Florida Bay. *In* Richardson, J.I. and T. H. Richardson (compilers), Proceedings of the Twelfth Annual Workshop on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-361. 117 pp.

Schueller, P., and D.L. Peterson. 2010. Abundance and recruitment of juvenile Atlantic sturgeon in the Altamaha River, Georgia. Transactions of the American Fisheries Society 139: 1526-1535.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184: 966 pp.

Secor, D.H. 1995. Chesapeake Bay Atlantic sturgeon: current status and future recovery. Summary of findings and recommendations from a workshop convened 8 November 1994 at Chesapeake Biological Laboratory. Chesapeake Bay Biological Laboratory, Center for Estuarine and Environmental Studies, University of Maryland System, Solomons, MD.

Secor, D.H. 2002. Atlantic sturgeon fisheries and stock abundances during the late nineteenth century. American Fisheries Society Symposium 28: 89-98.

Secor, D.H. and T.E. Gunderson. 1998. Effects of hypoxia and temperature on survival, growth, and respiration of juvenile Atlantic sturgeon (*Acipenser oxyrinchus*). Fishery Bulletin U.S. 96: 603-613.

Secor, D.H. and E.J. Niklitschek. 2001. Hypoxia and sturgeons. Chesapeake Biological Laboratory Technical Report Series-Number TS-314-01-CBL. 26 pp.

Secor, D.H. and E.J. Niklitschek. 2003. Sensitivity of sturgeons to environmental hypoxia: physiological and ecological evidence. Pp 61-78 In: Fish Physiology, Toxicology, and Water Quality – Proceedings of the Sixth International Symposium, La Paz, Mexico, January 22-26, 2001. U.S. EPA Office of Research and Development, Ecosystems Research Division, Athens, Georgia.

Secor, D. H. and J. R. Waldman. 1999. Historical abundance of Delaware Bay Atlantic sturgeon and potential rate of recovery. American Fisheries Society Symposium 23: 203-216.

Secor, D., P. Anders, V.W. Webster, and D. Dixon. 2002. Can we study sturgeon to extinction? What we do and don't know about the conservation of North American sturgeon. Pages 3-9. In: V.W. Webster et al. (eds.) Biology, management, and protection of North American sturgeon, Symposium 28. American Fisheries Society, Bethesda, Maryland

Shaver, D.J. 1991. Feeding ecology of wild and head-started Kemp's ridley sea turtles in south Texas waters. Journal of Herpetology. Vol. 23, 1991.

Shaver, D.J. 1994. Relative abundance, temporal patterns, and growth of sea turtles at the Mansfield Channel, Texas. Journal of Herpetology 28: 491-497.

Shoop, C., T. Doty and N. Bray. 1982. A characterization of marine mammals and turtles in the mid- and north-Atlantic areas of the U.S. outer continental shelf: Final Report, December 1982. Univ. Rhode Island, Kingston.

Simberloff, D. 1988. The contribution of population and community biology to conservation science. Annual Review of Ecology and Systematics 19: 473-511.

Sindermann, C.J. 1994. Quantitative effects of pollution on marine and anadromous fish populations. NOAA Technical Memorandum NMFS-F/NEC-104, National Marine Fisheries Service, Woods Hole, Massachusetts.

Smith, T.I.J. 1985. The fishery, biology, and management of Atlantic sturgeon, *Acipenser oxyrinchus*, in North America. Environmental Biology of Fishes 14:61-72.

Smith, T.I.J. and J.P. Clugston. 1997. Status and management of Atlantic sturgeon, *Acipenser oxyrinchus*, in North America. Environmental Biology of Fishes 48: 335-346.

Smith, T.I.J., E.K. Dingley, and E.E. Marchette. 1980. Induced spawning and culture of Atlantic sturgeon. Progressive Fish Culturist 42:147-151.

Smith, T.I.J., D.E. Marchette, and R.A. Smiley. 1982. Life history, ecology, culture and management of Atlantic sturgeon, *Acipenser oxyrhynchus*, Mitchill, in South Carolina. South Carolina Wildlife and Marine Resources. Resources Department, Final Report to U.S. Fish and Wildlife Service Project AFS-9. 75 p.

Smith, T.I.J., D.E. Marchette, and G.F. Ulrich. 1984. The Atlantic sturgeon fishery in South Carolina. North American Journal of Fisheries Management 4: 164-176.

Smith, T.I.J., E. Kennedy and M.R. Collins. 1992. Identification of critical habitat requirements of shortnose sturgeon in South Carolina. Final Report to USFWS. Atlanta, Georgia.

Smith, T.I.J., M.R. Collins, and E.Kennedy. 1993. Identification of critical habitat requirements of shortnose sturgeon in South Carolina. Final Report Project AFS-17, USFWS. Atlanta, GA. 97 pp.

Smith, T. I. J., M.C. Collins, W.C. Post, and J.W. McCord. 2002. Stock enhancement of shortnose sturgeon: a case study. Pages 31–44 in W. Van Winkle, P. J. Anders, D.H. Secor, and D. A. Dixon, editors. Biology, management, and protection of North American sturgeon. American Fisheries Society, Symposium 28, Bethesda, Maryland.

Soule, M.E. 1986. Conservation biology: the science of scarcity and diversity. Sinauer Associates, Sunderland, Massachusetts.

Spencer, D., and L.B. Muzekari. 2002. Source Water Assessment Plans Across State Lines Beaufort Jasper Water & Sewer Authority and the City of Savannah. Presented at the 2002 South Carolina Environmental Conference.

Spotila, J.R., A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: are leatherback turtles going extinct? Chel. Conserv. Biol. 2(2): 209-222.

Stabenau, E.K. and K.R. Vietti. 1999. Physiological effects of short-term submergence of loggerhead sea turtles, *Caretta caretta*, in TED-equipped commercial fishing nets. Final Report to National Marine Fisheries Service, Pascagoula Laboratory, Pascagoula, Mississippi.

Standora, E.A., S.J. Morreale, A. Bolten, M.D. Eberle, J.M. Edbauer, T.S. Ryder, and K.L. Williams. 1993. Diving behavior, daily movements, and homing of loggerhead turtles (*Caretta caretta*) at Cape Canaveral, Florida. March and April 1993. Contr. Report to COE.

Stevenson, J.C. and M.S. Kearney. In press. Impacts of global climate change and sea level rise on tidal wetlands. In: B.R. Silliman, M.D. Bertness and D. Strong (eds.), Anthropogenic modification of North American salt marshes. Berkeley, CA: University of California Press.

Stevenson, J.C. and D.H. Secor. 1999. Age determination and growth of Hudson River Atlantic sturgeon, *Acipenser oxyrinchus*. Fishery Bulletin 97:153-166.

Swingle, M., S. Barco, T. Pitchford, W. McLellan and D.A. Pabst. 1993. The occurrence of foraging juvenile humpback whales (*Megaptera novaeangliae*) in Virginia Coastal Waters. Marine Mammal Science. 9(3):309-315.

Taubert, B.D. 1980. Reproduction of the shortnose sturgeon (*Acipenser brevirostrum*) in Holyoke Pool, Connecticut River, Massachusetts. Copeia 1: 114-117.

Taubert. B.D. and M.J. Dadswell. 1980. Description of some larval shortnose sturgeon (*Acipenser brevirostrum*) from the Holyoke Pool, Connecticut River, Massachusetts, U.S.A. and the Saint John River, New Brunswick, Canada. Canadian Journal of Zoology 58: 1125-1128.

TEWG (Turtle Expert Working Group). 1998. An Assessment of the Kemp's ridley sea turtle (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the western North Atlantic. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-409. 96 pp.

TEWG (Turtle Expert Working Group). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the Western North Atlantic. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-444. 115 pp.

TEWG (Turtle Expert Working Group). 2007. An Assessment of the Leatherback Turtle Population in the Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-555, 116p.

TEWG (Turtle Expert Working Group). 2009. An Assessment of the Loggerhead Turtle Population in the Western North Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-575, 131p.

Thomas, C.D. 1990. Environmental fluctuations and extinction – single species. Theoretical Population Biology 27: 1-26.

Thomas, C.D. 1994. Extinction, colonization, and metapopulations: environmental tracking by rare species. Conservation Biology 8: 373-378.

Tillman, M. 2000. Internal memorandum, dated July 18, 2000, from M. Tillman (NMFS-Southwest Fisheries Science Center) to R. McInnis (NMFS-Southwest Regional Office).

USACE. 2011. Sea Turtle Data Warehouse. http://el.erdc.usace.army.mil/seaturtles/.

USDOI (U.S. Department of Interior). 1973. Threatened wildlife of the United States. Resource Publication 114, March 1973.

USFWS (U.S. Fish and Wildlife Service). 1993. Pallid Sturgeon Recovery Plan. U.S. Fish and Wildlife Service, Bismarck, North Dakota. 55 pp.

USFWS. 2000. Report on the Mexico/United States of America Population Restoration Project for the Kemp's ridley sea turtle, *Lepidochelys kempii*, on the coasts of Tamaulipas and Veracruz, Mexico.

USFWS and NMFS. 1992. Recovery Plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*). U.S. Fish and Wildlife Service, Washington, DC.

USFWS and NMFS. 1998. Consultation Handbook: Procedures for conducting consultation and conference activities under section 7 of the Endangered Species Act.

USFWS, NMFS, and SCDNR. 2001. Santee-Cooper Basin Diadromous Fish Passage Restoration Plan. 72 pp.

van Dam, R.P., and C.E. Diez. 1998. Home range of immature hawksbill turtles (*Eretmochelys imbricata*) at two Caribbean islands. J. Exp. Mar. Biol. Ecol. 220:15-24.

Van Den Avyle, M. J. 1984. Species profile: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Atlantic sturgeon. U.S. Fish and Wildlife Service Report No. FWS/OBS-82/11.25, and U. S. Army Corps of Engineers Report No. TR EL-82-4, Washington, D.C.

Vanderlaan, A.S.M and C.T. Taggart. 2007. Vessel collisions with whales: The probability of lethal injury based on vessel speed. Marine Mammal Science 23(1):144-156.

Van Dolah, R.F., D.R. Calder, F.W. Stapor, Jr., R.H. Dunlap, and C.R. Richter. 1979 Atlantic Intracoastal Waterway environmental studies at Sewee Bay and North Edisto River. South Carolina Marine Resources Center Technical Report No. 39. South Carolina Wildlife and Marine Resources Department, Charleston, SC.

Van Dolah, R.F., D.R. Calder, and D.M. Knott. 1984. Effects of dredging and open water disposal on benthic macroinvertebrates in a South Carolina estuary. Estuaries 7:28-37.

Van Eenennaam, J.P., S.I. Doroshov, G.P. Moberg, J.G. Watson, D.S. Moore, and J. Linares. 1996. Reproductive conditions of the Atlantic sturgeon (*Acipenser oxyrhichus*) in the Hudson River. Estuaries 19: 769-777.

Varanasi, U. 1992. Chemical contaminants and their effects on living marine resources. Pp 59-71 In: R.H. Stroud (ed.) Stemming the Tide of Coastal Fish Habitat Loss. Proceedings of the Symposium on Conservation of Fish Habitat, Baltimore, Maryland. Marine Recreational Fisheries Number 14. National Coalition for Marine Conservation, Inc., Savannah, Georgia.

Vargo, S., P. Lutz, D. Odell, E. van Vleet, and G. Bossart. 1986. The effects of oil on marine turtles. Final Report, Vol. 2. Prepared for Mineral Management Services, U.S. Department of Interior. OCS Study MMS 86-0070

Vecsei, P. and D. Peterson. 2004. Sturgeon ecomorphology: A descriptive approach. Pp 103-133 In: G.T.O. LeBreton et al. (eds.) Sturgeons and Paddlefishes of North America. Kluwer Academic, Netherlands.

Vladykov, V. D. and J. R. Greely. 1963. Order Acipenseroidei. In: Fishes of Western North Atlantic. Sears Foundation. Marine Research, Yale Univ. 1630 pp.

von Westernhagen, H., H. Rosenthal, V. Dethlefsen, W. Ernst, U. Harms, and P.D. Hansen. 1981. Bioaccumulating substances and reproductive success in Baltic flounder *Platichthys flesus*. Aquatic Toxicology 1:85-99.

Waldman, J.R., J.T. Hart, and I. Wirgin. 1996. Stock composition of the New York Bight Atlantic sturgeon fishery based on analysis of mitochondrial DNA. Trans. Am. Fish. Soc. 125:364–371.

Waldman, J.R., C. Grunwald, J. Stabile, and I. Wirgin. 2002. Impacts of life history and biogeography on the genetic stock structure of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus*, Gulf sturgeon *A. oxyrinchus desotoi*, and shortnose sturgeon *A. brevirostrum*. Journal of Applied Ichthyology 18: 509-518.

Wallace, B.P., S.S. Heppell, R.L. Lewison, S. Kelez, and L.B. Crowder. 2008. Impacts of fisheries bycatch on loggerhead turtles worldwide inferred from reproductive value analyses. Journal of Applied Ecology 45:1076–1085.

Walsh, M.G., M.B. Bain, T. Squires Jr., J.R. Waldman, and I. Wirgin. 2001. Morphological and genetic variation among shortnose sturgeon *Acipenser brevirostrum* from adjacent and distant rivers. Estuaries 24: 41-48.

Wang, Y.L. F.P. Binkowski and S.I. Doroshov. 1985. Effect of temperature on early development of white and lake sturgeon, *Acipenser transmontanus* and *A. fulvescens*. Environmental Biology of Fishes 14: 43-50.

Weber, W. 1996. Population size and habitat use of shortnose sturgeon, *Acipenser brevirostrum*, in the Ogeechee River system, Georgia. MSc. Thesis. University of Georgia, Athens, Georgia.

Weber, W., C.A. Jennings, and S.G. Rogers. 1999. Population size and movement patterns of shortnose sturgeon in the Ogeechee River system, Georgia. Proceedings of the annual conference of the Southeastern Association of Fish and Wildlife Agencies. 52: 18-28.

Weishampel, J.F., D.A. Bagley, and L.M. Ehrhart. 2004. Earlier nesting by loggerhead sea turtles following sea surface warming. Global Change Biology, 10:1424-1427

Welcomme, R.L. 1995. Relationships between fisheries and the integrity of river systems. Regulated Rivers: Research and Management 11: 121-136.

Wershoven, J.L. and R.W. Wershoven. 1992. Juvenile green turtles in their nearshore habitat of Broward County, Florida: a five year review. *In* Salmon M. and J. Wyneken (compilers), Proceedings of the Eleventh Annual Workshop on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFC-302: 121-123.

Wiley, D.N., R. A. Asmutis, T.D. Pitchford, and D.P. Gannon. 1995. Stranding and mortalities of humpback whales, *Megaptera novaeangliae*, in the mid-Atlantic and southeast United States, 1985-1992. Fishery Bull. 93:196-205.

Williamson, M. 1981. Island populations. Oxford University Press, Oxford.

Winger, P. V., P. J. Lasier, D. H. White, J. T. Seginak. 2000. Effects of contaminants in dredge material from the lower Savannah River. Archives of Environmental Contamination and Toxicology 38: 128-136.

Wirgin, I., J.R. Waldman, J. Rosko, R. Gross, M. Collins, S.G. Rogers, and J. Stabile. 2000. Genetic structure of Atlantic sturgeon populations based on mitochondrial DNA control region sequences. Transactions of the American Fisheries Society 129: 476-486.

Wirgin, I., J. Waldman, J. Stabile, B. Lubinski and T. King. 2002. Comparison of mitochondrial DNA control region sequence and microsatellite DNA analyses in estimating population structure and gene flow rates in Atlantic sturgeon (*Acipenser oxyrinchus*). Journal of Applied Ichthyology 18: 313-219.

Wirgin, I., C. Grunwald, E. Carlson, J. Stabile, D.L. Peterson, and J. Waldman. 2005. Range-wide population structure of shortnose sturgeon *Acipenser brevirostrum* based on sequence analysis of the mitochondrial DNA control region. Estuaries 28(3): 406-421.

Wirgin, I., C. Grunwald, J. Stabile and J.R. Waldman. 2009. Delineation of discrete population segments of shortnose sturgeon *Acipenser brevirostrum* based on mitochondrial DNA control region sequence analysis. Conserv. Genet. doi: 10.1007/s10592-009-9840-1.

Witherington, B., P. Kubilis, B. Brost, and A. Meylan. 2009. Decreasing annual nest counts in a globally important loggerhead sea turtle population. Ecological Applications 19:30–54.

Witzell, W.N. 2002. Immature Atlantic loggerhead turtles (*Caretta caretta*): suggested changes to the life history model. Herpetological Review 33(4): 266-269.

Witzell, W.N. and J.R. Schmid. 2005. Diet of immature Kemp's ridley turtles (*Lepidochelys kempi*) from Gullivan Bay, Ten Thousand Islands, southwest Florida. Bull. Mar. Sci. 77: 191-199.

Wooley, C.M. and E.J. Crateau. 1985. Movement, microhabitat exploitation and management of Gulf of Mexico sturgeon, Apalachicola River, Florida. North Am. J. Fish Manage. 5, 590–605.

Wueringer, B.E., L. Squire, Jr., S.M. Kajiura, N.S. Hart, and S.P. Collin. 2012. The Function of the Sawfish’s Saw. Current Biology (22) 5.

Wyneken, J., K. Blair, S. Epperly, J. Vaughan, and L. Crowder. 2004. Surprising sex ratios in west Atlantic loggerhead hatchlings – an unexpected pattern. Poster presentation at the 2004 International Sea Turtle Symposium in San Jose, Costa Rica.

Young, J.R., T.B. Hoff, W.P. Dey, and J.G. Hoff. 1988. Management recommendations for a Hudson River Atlantic sturgeon fishery based on an age-structured population model. Fisheries Research in the Hudson River. State of University of New York Press, Albany, New York. 353 p.

Ziegeweid, J.R., C.A. Jennings, and D.L. Peterson. 2008a. Thermal maxima for juvenile shortnose sturgeon acclimated to different temperatures. Environmental Biology of Fishes 82: 299-307.

Ziegeweid, J.R., C.A. Jennings, D.L. Peterson, and M.C. Black. 2008b. Effects of salinity, temperature, and weight on the survival of young-of-year shortnose sturgeon. Environmental Biology of Fishes 137:1490-1499.

Zurita, J.C., R. Herrera, A. Arenas, M.E. Torres, C. Calderon, L. Gomez, J.C. Alvarado, and R. Villavicencio. 2003. Nesting loggerhead and green sea turtles in Quintana Roo, Mexico. Pp. 125-127 *In*: Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum. NMFS SEFSC.

Zwinenberg. A.J. 1977. Kemp’s ridley, *Lepidochelys kempii* (Garman, 1880), undoubtedly the most endangered marine turtle today (with notes on the current status of *Lepidochelys olivacea*). Bulletin of the Maryland Herpetological Society, 13(3): 170-192.

Appendix 1: NMFS Biological Opinion to the U.S. Army Corps of Engineers. November 19, 2003, "Dredging of Gulf of Mexico Navigation Channels and Sand Mining ("Borrow") Areas Using Hopper Dredges by COE Galveston, New Orleans, Mobile, and Jacksonville Districts," (Consultation Number F/SER/2000/01287).

Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency:	United States Army Corps of Engineers (COE)
Activity	Dredging of Gulf of Mexico Navigation Channels and Sand Mining ("Borrow") Areas Using Hopper Dredges by COE Galveston, New Orleans, Mobile, and Jacksonville Districts (Consultation Number F/SER/2000/01287)
Consulting Agency:	National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, Protected Resources Division, St. Petersburg, Florida
Approved by:	Roy E. Crabtree, Ph.D., Regional Administrator NOAA Fisheries, Southeast Regional Office St. Petersburg, Florida
Date Issued:	NOV 19 2003

Contents

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. When the action of a Federal agency may affect a protected species, that agency is required to consult with either the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) or the U.S. Fish and Wildlife Service (FWS), depending upon the protected species that may be affected.

This document represents NOAA Fisheries' biological opinion (Opinion) based on our review of the regular maintenance hopper dredging of navigation channels, and offshore sand mining for beach restoration/nourishment activities, in the U.S. Gulf of Mexico by the COE's Jacksonville, Mobile, New Orleans, and Galveston Districts, and its effects on green sea turtles *(Chelonia mydas*), leatherback sea turtles (*Dermochelys coriacea*), hawksbill sea turtles *(Eretmochelys imbricata*), loggerhead sea turtles (*Caretta caretta*), Kemp's ridley sea turtles *(Lepidochelys kempii*), Gulf sturgeon (*Acipenser oxyrinchus desotoi*), and Gulf sturgeon critical habitat, in accordance with section 7 of the ESA.

Formal consultations are required when action agencies determine that a proposed action "may affect" listed species or designated critical habitat. Formal consultations on most listed marine species are conducted between the action agency and NOAA Fisheries. Consultations are concluded after NOAA Fisheries' issuance of an 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 also states the amount or extent of incidental taking that may occur. Non-discretionary measures ("reasonable and prudent measures" - RPMs) to reduce the likelihood of takes are developed, and conservation recommendations are made. Notably, there are no reasonable and prudent measures associated with critical habitat, only reasonable and prudent alternatives.

This Opinion is based on dredging schedules and biological assessments provided by the various Gulf of Mexico COE Districts for channel dredging and beach nourishment projects involving the use of hopper dredges, meetings between NOAA Fisheries and the COE, annual take reports, dredge observer reports, dredging project completion reports, and annual dredging project summary reports provided by the COE Districts. Draft versions of this Opinion were provided to the COE Districts for input and comments, and resulted in significant revisions to the final draft.

1.0 Consultation History

This Opinion is a result of reinitiation of consultation on the September 22, 1995, Regional Biological Opinion (RBO) issued to the U.S. Army Corps of Engineers, New Orleans and Galveston Districts, on hopper dredging of channels in Texas and Louisiana. At the time that the Galveston and New Orleans Districts requested reinitiation of consultation on the RBO, NOAA Fisheries' Southeast Regional Office requested that the Mobile District and the Jacksonville District–the other two COE Districts that conduct hopper dredging operations in the Gulf of Mexico–also enter into formal ESA consultation with NOAA Fisheries and provide biological assessments (BA) on the effects of their Districts' maintenance dredging projects and beach nourishment projects on threatened and endangered species under NOAA Fisheries' purview in the Gulf of Mexico. This allowed NOAA Fisheries to prepare the present comprehensive regional biological opinion to cover all hopper dredging activities in the Gulf of Mexico which involve maintenance dredging or sand mining by or under the auspices of the U.S. Army Corps of Engineers.

The Galveston District's BA and request for reinitiation of formal consultation were submitted on October 11, 2000.

The New Orleans District's BA and request for reinitiation of formal consultation were received on April 9, 2001.

The COE's Mobile District provided information on hopper dredging projects within its area of jurisdiction on December 21, 2001, and additional information was provided at a meeting between NOAA Fisheries and COE representatives in Mobile on April 15, 2002. The Mobile District's BA was received on June 12, 2002.

The Jacksonville District submitted a BA dated April 29, 1999, on the Lee County Shore Protection Project, Estero Island Segment (Gasparilla Island) hopper dredging; additional information on this project was received on April 4, 2000. The Jacksonville District requested formal consultation and submitted a BA on their Florida west coast hopper dredging projects on November 28, 2000. On July 17, 2001, the Jacksonville District submitted a separate BA and request for formal consultation on the Lido Key Shore Protection Project. NOAA Fisheries requested additional information on the Lido Key project on August 9, 2001, which was provided by the COE on September 7, 2001. In their letter, the COE agreed to NOAA Fisheries' request to include the Lido Key project in the present Opinion. On August 22, 2001, the COE provided information on the Pinellas County Shore Protection Project; a BA and request for formal consultation was provided on October 30, 2002. That consultation is included in the present Opinion. In March 2002, NOAA Fisheries received a request for formal consultation from the COE on the Pensacola Beach Restoration Project and decided to include and evaluate the proposed action in the present Opinion, since the project called for hopper dredge use. Ultimately, the latter project was consulted on separately from the present Opinion, in a biological opinion issued in October 2002. On May 9, 2003, and again on August 8, 2003, NOAA Fisheries received a request for formal consultation on the proposed Sarasota County, Venice Beach Shoreline Protection Project since hopper dredging of offshore sand mining sites may be involved. That project is included in this Opinion.

The COE's Mobile District provided information on hopper dredging projects within its area of jurisdiction on December 21, 2001, and additional information was provided at a meeting between NOAA Fisheries and COE representatives in Mobile on April 15, 2002. The Mobile District's BA was received on June 12, 2002.

The Mobile District provided written comments on draft versions of this Opinion on September 6, 2002, and October 30, 2002.

The COE's South Atlantic Division provided comments on the draft Opinion on October 1, 2002, (e-mail, Barnett to Nitta) and on November 14, 2002 (e-mail, Small to Hawk).

The COE's Wilmington District provided comments on the draft Opinion on September 11 and 13, 2002 (e-mails, Adams to Hawk).

The COE's Jacksonville District provided comments on the draft Opinion on September 13, 2002 (Jordan to Adams). Additional comments (Haberer to Hawk) were received on April 29, 2003.

The COE's South Atlantic Division (SAD) compiled comments received from the COE's South Atlantic, Mississippi Valley, and Southwest Divisions, and the Jacksonville, Mobile, New Orleans, and Galveston Districts on the August 24, 2003, final draft Opinion, and provided these to NOAA Fisheries on September 9, 2003. NOAA Fisheries responded to these comments verbally to South Atlantic Division staff on September 25, 2003, made revisions to the final draft, and provided revised copies to the COE on October 15, 2003 for final comment. NOAA Fisheries requested that comments be submitted by October 21, 2002, although comments received through October 29, 2003 were considered.

A complete administrative record of this consultation is on file at the NOAA Fisheries' Southeast Regional Office, St. Petersburg, Florida.

Background to Proposed Action

Consultation History of Channel Dredging in the United States

The construction and maintenance of Federal navigation channels have been identified as a source of turtle mortality since turtle takes were first documented during hopper dredging operations in Canaveral Channel, Florida, in 1980. A total of 71 turtle takes by hopper dredge was documented in the Canaveral Channel over the period of July 11 through November 13, 1980 (NMFS 1991a). Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore sand mining areas, move relatively rapidly and can entrain and kill sea turtles, presumably as the drag arm of the moving dredge overtakes the slower moving turtle. In contrast to hopper dredges, pipeline dredges are relatively stationary, and therefore act on only small areas at any given time. In the 1980s, observer coverage was required by NOAA Fisheries at pipeline outflows during several dredging projects deploying pipeline dredges along the Atlantic coast. No turtles or turtle parts were observed in the outflow areas. Additionally, the COE's South Atlantic Division (SAD) office in Atlanta, Georgia, charged with overseeing the work of the individual COE Districts along the Eastern Seaboard from North Carolina through Florida, provided documentation of hundreds of hours of informal observation by COE inspectors during which no takes of listed species were observed. Additional monitoring by other agency personnel, conservation organizations, and the general public has never resulted in reports of turtle takes by pipeline dredges (NMFS 1991a).

U.S. Gulf of Mexico

Historically, section 7 consultations conducted on dredging impacts in the Gulf of Mexico were limited by the paucity of information available on the seasonal and spatial distribution of sea turtles; information was also lacking on adverse impacts of hopper dredging on local species under NOAA Fisheries' jurisdiction. Studies conducted by the COE (Dickerson et al. 1994) documented turtle distribution and abundance in 6 channels along the Atlantic seaboard but there was no evidence that indicated that sea turtles in Gulf channels aggregate like those along the southeast U.S. Atlantic coast.

A brief history (beginning 1990) of section 7 consultations conducted on dredging activities in the northern and western Gulf of Mexico follows. All of these consultations concluded that dredging was not likely to jeopardize listed species in the Gulf of Mexico.

New Orleans District

Beginning in 1991, the COE New Orleans District has held annual dredging conferences and has compiled a conference notebook requesting section 7 consultation on anticipated dredging projects for the upcoming fiscal year. Information on the proposed maintenance dredging dates, anticipated dredge types, and amount of material to be dredged is included within the conference notebook. The annual consultations resulting from the projects within the conference notebook were generally concluded informally, with a concurrence from NOAA Fisheries that hopper dredging in these channels was not likely to adversely affect any listed species or critical habitat. Since 1990, reporting conditions have been implemented that required precautionary measures to improve the information available on interactions between sea turtles and hopper dredge activities in the Gulf. The COE New Orleans District was asked to (1) advise inspectors, operators, and vessel captains about the prohibitions on taking, harming, or harassing sea turtles, and the civil penalties that apply; (2) instruct the captain of the hopper dredge to avoid any turtles encountered while traveling between the dredge site and offshore disposal area, and to immediately contact the COE if sea turtles were seen in the vicinity; and (3) notify NOAA Fisheries if sea turtles were observed in the dredging area in order to coordinate further precautions to avoid impacts to turtles.

A COE-funded research program was conducted during 1993 and 1994 to assess the occurrence of sea turtles in the vicinity of Calcasieu Pass, Louisiana. The COE New Orleans District suggested that ongoing research assessing sea turtle occurrence in the vicinity of the channel during the dredging period, and observations by dredge workers and COE observers, were sufficient to preclude the need for NOAA Fisheries-approved observers.

The COE requested consultation in summer 1994 for FY 1995 channel dredging within the New Orleans District where a hopper dredge was likely to be used. Dredging areas included Calcasieu Pass, Mississippi River - Gulf Outlet (MR-GO), and the Mississippi River - Southwest Pass (MR-SWP). Preliminary studies of sea turtle occurrence in Calcasieu and Sabine passes suggested that sea turtles may congregate in the vicinity of some passes along the northern Gulf of Mexico at specific times of the year. Also, high levels of sea turtle strandings had been documented over the past few years on Louisiana beaches, despite the lack of a dedicated, organized stranding network.

In response to the COE New Orleans District's request for consultation, NOAA Fisheries issued a letter dated January 30, 1995, indicating that NOAA Fisheries-approved observers were necessary to verify the reported absence of dredging impact in these channels on listed sea turtle species. The letter also suggested that formal consultation would be required in 1995 incorporating the results of the Calcasieu sea turtle study and observer reports. NOAA Fisheries also suggested that the newly-developed rigid deflector draghead be immediately deployed on the dredges if possible.

During FY 1995, the COE New Orleans District determined that observers would not be deployed in the MR-SWP since the channel consisted primarily of fresh, high flow waters. Additionally, the complexity of dredging operations in MR-SWP results in up to seven hopper dredges operating at any time in any part of the MR-SWP, often with less than ten days notice, making deploying observers difficult. Dredging effort and location are dependant on weather, resultant flow, and siltation from up-river (International Dredging Review 1995). Variable dredging demands make it difficult to obtain 100% observer coverage at the appropriate extents of the MR-SWP.

However, NOAA Fisheries-approved observers were deployed on a hopper dredge operating in Calcasieu Pass during maintenance dredging operations between April 27 and July 8, 1995. No sea turtle takes were observed. Reports indicated that sufficient screening and observer effort were present to have observed a potential take. NOAA Fisheries-approved endangered species observers also attended maintenance dredging operations in the MR-GO between March 18 and May 10, 1995. No sea turtles were taken nor observed in the vicinity. Very little biological material was observed in the dredge spoil.

COE New Orleans District requested formal consultation in March 1995 on the effects of the proposed District-wide dredging and submitted a BA in July 1995. The resulting RBO on the use of hopper dredges to conduct maintenance dredging in Texas and Louisiana channels, issued on September 22, 1995 (NMFS 1995a), concluded that hopper dredging in the northern Gulf of Mexico was likely to adversely affect listed sea turtles, but was not likely to jeopardize the continued existence of sea turtle populations.

While the RBO authorized the New Orleans District an annual incidental take, lethal or injurious, by hopper dredge of 15 loggerhead, three green, seven Kemp's ridley, and one hawksbill sea turtle (NMFS 1995a), this take limit has not been reached for any species since the RBO was issued. In most years, New Orleans District takes have been far fewer than authorized (except in May 2002, when loggerhead takes in the MR-GO reached 75% of the authorized loggerhead limit). For example, from May 11, 1995, to September 13, 2003, June 1, 2003, a total of only 41 sea turtles (including 32 loggerheads, seven Kemp's ridleys, and two unidentified) has been reported lethally taken by hopper dredges in the New Orleans District. However, ten turtles, all loggerheads, were taken by the New Orleans District in FY2003, all in the MR-GO.

One of the measures implementing the RBO Incidental Take Statement (ITS) required observer presence in the seaward extent of MR-SWP between April 1 and November 30. A study proposed and conducted by COE New Orleans District in 1996 further characterized the habitat of the MR-SWP and helped identify the likelihood of turtle presence. Results indicated that the MR-SWP was an area not likely utilized by sea turtles. The 1996 sea turtle observer reports confirmed the absence of sea turtles, and the scarcity of sea turtle prey species found in hopper dredge inflow screens during dredging in the MR-SWP. On January 13, 1997, after reviewing their BA and MR-SWP habitat characterization study, NOAA Fisheries advised COE New Orleans District that further observer deployment in MR-SWP, as per the sea turtle observer monitoring requirements outlined in the ITS, was no longer required. There have been no documented takes of sea turtles in MR-SWP since the September 22, 1995, Opinion was issued.

Galveston District
Before the 1995 RBO, consultations had been conducted on a channel-by-channel basis within the COE's Galveston District. During a consultation conducted on the Sabine-Neches Waterway, NOAA Fisheries concurred on May 14, 1992, with COE Galveston District's finding that hopper dredging in the Waterway was not likely to adversely affect listed species. The conclusion for the Sabine-Neches Waterway was based on the lack of documented takes in the project area. However, NOAA Fisheries noted that the preliminary data collected in the project area suggested sea turtle presence in the channel area. As a precaution, NOAA Fisheries suggested that the COE Galveston District implement identical measures (1-3 above) as those required by the COE New Orleans District. These measures were followed on most hopper dredging projects conducted within the Galveston District between 1992 and May 1995.

Formal consultation conducted on hopper dredging in the Port Mansfield Channel resulted in an Opinion issued on September 12, 1992, restricting the use of hopper dredges during December through March. During these winter months, sea turtle observations by dredge personnel and COE dredge inspectors were required. The Opinion recommended the use of pipeline or bucket dredges during all months of the year as an alternative to hopper dredging in this channel. The Opinion also recommended that the COE adhere to National Park Service recommendations regarding dredge operations and disposal activities, and conduct studies to determine the seasonal abundance of sea turtles in the channel.

Informal consultation conducted on winter dredging of the Galveston Harbor and Channel in early 1995 indicated that formal consultation should be conducted for northern Gulf of Mexico hopper dredging projects between April and November due to new information collected by COE-funded research suggesting sea turtles were abundant in waters adjacent to channels. The need for formal consultation and requirements beyond COE observers was further demonstrated during take in a project within Brazos Pass, south Texas. Dredging began in February 1995, a time of year when historical information suggests that the relative abundance of sea turtles is low. On February 7 and 8, 1995, anterior portions of sea turtles were discovered on beaches adjacent to the Pass. Inquiries to the COE's Galveston District revealed two unreported observations by COE inspectors of live green turtles onboard the dredge the day after dredging began. Four additional strandings of green turtles with injuries indicative of dredging, and two lethal takes of green turtles were observed before dredging operations were halted on February 26. A Kemp's ridley lethal take was also observed. Total sea turtle take for the Brazos Pass project was 5 lethal and four non-lethal during 19 days, recording the first documentation of sea turtle takes by hopper dredges in Gulf of Mexico channels. The COE Galveston and New Orleans Districts were subsequently requested to initiate formal consultation as a result of both these documented takes and the new data describing the abundance of sea turtles near Gulf channels. Formal consultation was requested by Galveston on March 23, 1995, and by New Orleans on March 31, 1995, and a BA was submitted by the New Orleans District on July 20, 1995. The COE New Orleans District identified annual maintenance dredging needs and anticipated hopper dredge use for the lower Mississippi River, the bar channel of the

MR-GO, and the bar channel of the lower Calcasieu River. The COE Galveston District identified the Sabine-Neches Waterway, the Galveston Harbor Channel, Freeport Harbor, the Matagorda Ship Channel, the Corpus Christi Ship Channel, Port Mansfield, and the Brazos Island Harbor as maintenance dredging project areas requiring the use of hopper dredges.

September 22, 1995, Regional Biological Opinion (RBO)
NOAA Fisheries' RBO (NMFS 1995a) responded to both the New Orleans and Galveston Districts' consultation requests jointly and considered the effects of annual maintenance dredging by hopper dredges on listed sea turtles. Seasonal observers, screening, and deflector draghead requirements were instituted for most channel dredging. An incidental take level for each COE District by fiscal year was established. For the COE Galveston District, incidental take, by injury or mortality, was set at seven documented Kemp's ridleys, five green turtles, one hawksbill, and 15 loggerhead turtles. This take allotment represented a total allowable take per fiscal year for all channel dredging in the Galveston District. As noted previously, the RBO authorized the New Orleans District an annual incidental take, lethal or injurious, by hopper dredge of 15 loggerhead, three green, seven Kemp's ridley, and one hawksbill sea turtle. The Galveston District was allocated two additional green turtles in their incidental take statement due to their greater abundance in south Texas waters. Reasonable and prudent measures recommended were: (1) temporal windows for hopper dredge operation to reduce the probability of sea turtle interaction, (2) the use of shipboard endangered species observers to document incidental take when water temperatures were 12°C (53.6°F) or greater, (3) inflow and overflow screening of dredged materials to enable observers to identify take, and (4) use of the rigid turtle deflector dragheads in all channel areas of the Gulf of Mexico where take had either been documented or during periods of known sea turtle concentrations. After a Kemp's ridley was lethally taken on May 14, 2002, NOAA Fisheries reinitiated consultation with the New Orleans District COE and required that the sea turtle deflecting draghead be installed for Calcasieu River and Pass navigational channel dredging and during all hopper dredging projects in the New Orleans District, excepting MR-SWP (the COE had not previously been using the deflecting draghead at Calcasieu Pass).

Because relocation trawling had shown limited success in east coast channels (e.g., Canaveral and Brunswick) at temporarily reducing the abundance of sea turtles during periods in which dredging is required, a conservation recommendation was included in the RBO for the COE to consider conducting sea turtle relocation trawling in advance of hopper dredging in certain circumstances. Specifically, the RBO recommended that relocation trawling "should be considered if takes are documented early in a project that requires the use of a hopper dredge during a period in which large numbers of sea turtles may occur."

Since 1995, all Galveston and New Orleans District hopper dredging projects in the Gulf of Mexico, with the exception of the Houston-Galveston Navigation Channels (H-GNC) (which was the subject of a separate Opinion and corresponding ITS for widening and deepening of existing channels, and cutting of new channels), have been conducted under the authority and subject to the take limits of the RBO. Hopper dredging projects under the jurisdiction of the Mobile and Jacksonville Districts were consulted on by individual project requiring individual Opinions and ITS's (e.g., Tampa Bay and Charlotte Harbor, Florida); or in the case of the Mobile District, every five years under informal section 7 consultation procedures.

<u>COE Jacksonville District, Florida West Coast</u>
Informal consultation on the proposed dredging of 750,000 cubic yards (CY) of shoal material and biannual maintenance dredging of 265,000 CY of shoal material in Boca Grande Pass, Charlotte Harbor Entrance Channel (located about 60 miles south of Tampa Bay), was initiated on March 31, 1992, by the

Planning Division, Jacksonville District COE. A BA was transmitted pursuant to section 7 of the ESA. On April 29, 1992, NOAA Fisheries determined that the proposed maintenance dredging action by hopper, hydraulic pipeline, or mechanical dredge would not adversely affect listed species under NOAA Fisheries' purview.

On February 6, 1995, the COE Planning Division, Jacksonville District informed NOAA Fisheries that, as a result of positive testing results, the new turtle excluder "rigid deflector" draghead would be utilized both in Boca Grande Pass and on all other hopper dredging projects. The rigid deflector was developed under controlled conditions by the COE's Waterways Experimental Station (WES), now known as the Engineering Research and Development Center (ERDC).

NOAA Fisheries issued an Opinion to the COE on June 2, 1995, regarding the effects of hopper dredging of approximately 13.3 miles of channels leading into and within Tampa Bay. The Tampa Harbor Navigation Channel Opinion required the COE to (1) conduct pre-dredge trawling surveys for turtles prior to commencement of dredging operations, (2) utilize the newly developed turtle excluder rigid deflector on all dragheads, (3) provide 100% screening of the overflows, and the maximum possible screening of the inflows, (4) disengage dredging pumps when dragheads were not firmly on the bottom, and (5) provide NOAA Fisheries-approved observer monitoring of dredging operations at all (100%) times. The Opinion established an incidental take limit of two documented Kemp's ridley, hawksbill, leatherback or green turtles, in any combination, or three loggerheads, for maintenance hopper dredging of Egmont Bar Channel (Cut 1 and 2), Mullet Key Cut, and Cut A in the navigation channel to Tampa Bay.

The COE reinitiated formal consultation with NOAA Fisheries for the Tampa Harbor Navigation Channel hopper dredging project on April 2, 1996, following the lethal take of two Kemp's ridleys. The resultant Opinion, signed April 9, 1996, suggested additional conservation measures and established an additional incidental take level (in addition to the two Kemp's previously taken), and the deflecting draghead position was adjusted. Additional incidental take was designated as eight sea turtles, however no more than five sea turtles could be Kemp's ridley, hawksbill, leatherback, or green (i.e., up to eight loggerheads could be taken, but no more than five of the other four species combined, NMFS 1996c). Immediately after this new Opinion was issued, three sea turtles (two loggerheads and one Kemp's ridley) were lethally taken by the hopper dredge STUYVESANT during March 3-April 18, 1997 maintenance dredging of the Egmont Bar Channel. These takes occurred despite a pre-dredge trawl survey (conducted from February 13-18, encompassing approximately 30 hours of trawling) that captured, tagged, and relocated three Kemp's ridleys. Subsequent dragging (trawling) operations conducted from March 16 - April 26 during the dredging period resulted in three loggerhead sightings, but no sea turtle captures. In retrospect, it is likely that the pre-dredge trawling occurred too long before the actual hopper dredging to be of maximum benefit.

On October 30, 1998, a loggerhead sea turtle was taken by a hopper dredge conducting maintenance dredging of Charlotte Harbor Entrance Channel (Boca Grande Pass). On November 3, 1998, the COE requested formal consultation on periodic maintenance dredging of Charlotte Harbor Entrance Channel using a hopper dredge to remove approximately 265,000 CY of shoal material every two or three years. Maintenance dredging of Charlotte Harbor Entrance Channel, between October 20, 1998, and January 13, 1999, resulted in one loggerhead (non-lethal) take and three loggerhead surface sightings within 300 yards of the operating hopper dredge.

On June 8, 1999, during consultation on Charlotte Harbor Entrance Channel hopper dredging, NOAA Fisheries requested that the COE-Jacksonville District submit dredging schedules for all District projects to be performed over the next five years, and suggested that the District request initiation of consultation for a Regional Biological Opinion (RBO) to include *all* potential dredging sites within the Jacksonville District, including Tampa Bay and the ongoing Charlotte Harbor consultation. Subsequently, an Opinion for maintenance dredging of Charlotte Harbor Entrance Channel was issued on October 26, 1999, authorizing the incidental take of two loggerheads or Kemp's ridleys or greens or hawksbill sea turtles, and one Gulf sturgeon, per biennial dredging cycle. The Charlotte Harbor Opinion, because of reported incidental take of Gulf sturgeon by gill net fishermen in Boca Grande Pass, was the first Gulf of Mexico hopper dredging Opinion to anticipate dredge interactions with Gulf sturgeon. Previously, NOAA Fisheries had addressed hopper dredging impacts on Gulf sturgeon in section 7 consultations for channel maintenance dredging, believing that the projects were not likely to adversely affect the species given either the project's limited scope and/or the unlikely presence of Gulf sturgeon. While no Gulf sturgeon takes by hopper dredges have been reported since, allopatric sturgeon species on the Atlantic Seaboard have been taken occasionally by hopper dredge. The existing SAD RBO for hopper dredging between North Carolina through Florida limits the incidental take of shortnose sturgeon to five. Recent reports confirm the take of five shortnose sturgeon by a hopper dredge operating in the Kennebec River, Maine (Julie Crocker, NMFS NER, October 15, 2003, pers. comm. to Stephania Bolden, NMFS SER). Thus, NOAA Fisheries considers it prudent to address potential Gulf sturgeon takes by hopper dredges operating in the Gulf of Mexico as we presume the species can be taken given the evidence from two morphologically and ecologically similar Atlantic sturgeon species.

On September 5, 2000, the COE requested consultation on maintenance dredging of St. Petersburg Harbor Entrance Channel, within Tampa Bay, using a hopper dredge. NOAA Fisheries concluded that the ITS and conclusions of the 1996 Tampa Harbor Navigation Channel Opinion remained valid and included this within-bay maintenance dredging. A pre-dredging assessment trawl survey from September 21-28 (approximately 29 hours of trawling) in the proposed dredging area resulted in the capture, tagging, and relocation of two adult loggerheads and one subadult green turtle. Subsequent dredging operations conducted from late September to October 2000, resulted in surface sightings of three turtles, but no captures.

2.0 Description of the Action Area and Proposed Action

The action area (defined in 50 CFR 402.02 as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action") for this action is the coastal waters, navigation channels, and sand mining areas in the U.S. Gulf of Mexico, from the Texas-Mexico marine border to Key West, Florida.

The proposed action includes:

1) Federal, federally-permitted, or federally-sponsored hopper dredging for maintenance of all U.S. Gulf of Mexico navigation channels within all of the COE's Gulf of Mexico Districts (Galveston, New Orleans, Mobile, and Jacksonville), including intracoastal waterways, maintenance dredging associated

with the Houston-Galveston navigation channels,[1] and maintenance dredging associated with the Corpus Christi Ship Channel Improvement Project.[2]

2) Federal, federally-permitted, or federally-sponsored hopper dredging of all U.S. Gulf of Mexico sand mining areas ("borrow sites") and virgin (previously unused) sand mining areas for beach nourishment, restoration, and protection projects, outside of designated Gulf sturgeon critical habitat, in state waters.

3) Hopper dredging projects including Federal civil works projects, Federal non-civil works projects authorized by COE regulatory permits, and non-Federal projects authorized by COE regulatory permits including privately-sponsored projects and cost-shared projects (part private, part Federal funding).

4) Maintenance (maintenance dredging is defined as keeping channels at specified depths and widths; improving means making them deeper or wider) hopper dredging of Gulf of Mexico navigation channels previously dredged by non-hopper type dredges.

5) Hopper dredging tests, in state waters, to determine a site's sand characteristics and suitability for future sand mining and beach restoration activities.

6) Emergency hopper dredging necessary due to disasters, storms, hurricanes, floods, etc., and national defense.

7) Disposal of hopper-dredged material in approved disposal areas. The COE has stated that economic concerns (e.g., time-of-transit to disposal sites versus time spent actually dredging) dictate that disposal of dredged materials occurs in the vicinity of the dredge sites, usually alongside or downdrift of the channels being dredged in designated placement areas or nearby designated ocean placement sites, often just off barrier island passes. Descriptions of dredged material disposal/placement sites are included herein by reference to charts and figures provided by the Gulf of Mexico COE Districts.

8) Hopper dredging of channels and turning basins beyond previously authorized depths and dimensions (i.e., "new material" dredging) if the action is described in the following project descriptions by COE District (e.g., Jacksonville District's Alafia River project) and only when the project is located outside of designated Gulf sturgeon critical habitat.

9) "New material" hopper dredging including widening, deepening, and extending of existing navigation channels and turning basins to previously authorized dimensions for channels and turning basins outside of designated Gulf sturgeon critical habitat.

10) Bed-leveler mechanical dredging of channels, turning basins, dredged material disposal areas, etc., located outside of designated Gulf sturgeon critical habitat using plows, I-beams, or other bed-leveling mechanical dredging devices used during or after hopper dredging or by themselves to lower high spots in the channel bottom or dredged material deposition areas.

[1] A separate Opinion for the Houston-Galveston navigation channels was previously issued to cover takes during widening, extending, and deepening.

[2] A separate Opinion was finalized in December 2002 on this project to cover takes during widening, extending, and deepening.

Except as noted in 8) and 9) above, "new material"dredging, i.e., hopper dredging to build, deepen, widen, or extend channels and turning basins, is not considered part of the proposed action evaluated in this Opinion and must be consulted on individually by the appropriate COE Districts.

This Opinion does NOT include:

1. Improvement (maintenance dredging is defined as keeping channels at specified depths and widths; improving means making them deeper or wider) of channels to depths or widths not previously authorized throughout the project area.

2. Dredging in areas within designated Gulf sturgeon critical habitat. Such dredging is limited to maintaining the current dimensions of channels at the time of this consultation (i.e., length, width, and depth) regardless of previous authorization. As addressed throughout the rule designating Gulf sturgeon critical habitat, dredging is an activity that may adversely modify critical habitat and therefore must be evaluated on a case-by-case basis.

3. Disposal in areas within designated Gulf sturgeon critical habitat. Such disposal is not authorized nor considered within this Opinion. As addressed throughout the rule designating Gulf sturgeon critical habitat, dredging is an activity that may destroy or adversely modify critical habitat and therefore must be evaluated on a case-by-case basis.

4. Hopper dredging permitted by other Federal agencies (e.g., Minerals Management Service - MMS) for characterizing or obtaining sand for beach renourishment projects in the Gulf of Mexico; although disposal of said sand obtained from outside state waters (i.e., from waters under the permitting purview of MMS, not the COE) is considered part of the proposed action, except for sand disposal within designated Gulf sturgeon critical habitat. Note: Although the COE may issue permits for the disposal in state waters of hopper dredged sand obtained from outside state waters (i.e., from Federal waters under MMS permitting authority), this Opinion does not consider (or hold the COE responsible for) any threatened or endangered species takes arising from non-COE permitted hopper dredging of sand sources outside of the COE's permitting authority.

New Orleans District

The COE New Orleans District has identified the following channels where regular maintenance dredging is required and use of hopper dredges is anticipated.

1. Mississippi River, Baton Rouge to the Gulf of Mexico, Southwest Pass - the lower Mississippi River (mile 4.0 above Head of Passes to mile 22.0 below Head of Passes, Southwest Pass): Maintenance dredging is required, conducted by private (contract) and government-owned hopper dredges for 8-12 months each year. Last dredged in 2002, the FY2004 dredging conference notebook indicates that maintenance dredging of the MR-SWP and the associated bar channel will be conducted by a cutterhead, hopper, and dustpan dredge beginning December 2003 continuing for approximately 8 months to remove approximately 18.8 million CY of material (25% sand, 50% silt, 25% clay). Authorized channel depth is 55 feet. Currently the channel is maintained to 45 feet. Disposal will occur in open water by agitation, placement in a designated ocean placement site, wetland creation and bank nourishment.

2. Mississippi River, Deep Draft Crossings - New Orleans Harbor to Baton Rouge: Maintenance dredging is required, conducted by government-owned hopper dredge and contract dustpan dredge for six months each year. The FY2004 dredging conference notebook, submitted in May 2003 indicates that maintenance dredging of the 45-ft deep x 500-ft wide channel will be conducted by both hopper and

dustpan dredge beginning June 2004 and continuing for approximately 6 months, to remove approximately 16.5 million CY of material (100% sand) between miles 230.7 and 114.8. Open water disposal is proposed in the deep water in vicinity of the crossings.

3. Mississippi River - Gulf Outlet: Maintenance dredging of the MR-GO channel involves non-continuous work from mile -66.0 to mile -9.0, and requires both hopper and cutterhead dredges. Routine maintenance dredging and disposal plans (non-emergency status) by cutterhead dredge can be performed throughout the entire project reach; hopper dredging is utilized in the bar channel reach only. Normally, the reach of the bar channel between mile -3.3 and -9.0 is maintained by hopper dredge. Maintenance dredging is conducted for approximately three months annually by both contract and government-owned hopper dredges. Last dredged in FY 2002, during FY2004 maintenance dredging on the MR-GO bar channel between mile -4.0 and -9.38 is anticipated to begin in September 2004 and continue for approximately 60 days, to remove approximately 1.5-2.5 million CY of material (33% sand, 57% silt, 10% clay). Open water dredged material placement is proposed between miles -4.0 and -9.38 in the ocean dredged material disposal site alongside the channel or on Breton Island. Additionally, hopper dredging work may occur between miles 23.0 and 12.0. Last dredged in 2002, approximately 2.0-6.0 million CY of material is proposed to be dredged, by cutterhead and hopper, starting in June 2004, for 90 days. Unconfined disposal is planned for wetland development behind South Jetty.

The COE New Orleans District requested on April 8, 2002, that hopper dredges be permitted to remove shoal material in the MR-GO navigational channel between mile 27.0 and -9.38 in the event that emergency maintenance dredging is required, only when cutterhead dredges are either unable to perform such work or are unable to provide project dimensions in a timely manner. On April 29, 2003, the District requested that hopper dredges be permitted to remove shoal material in the MR-GO navigational channel between mile 27.0 and -0 under the same conditions as previously noted. Conditions noted by the District that would precipitate emergency hopper dredge sidecasting of dredged material within authorized channel dimensions for later cutterhead dredge removal and disposal include: (a) extreme weather working conditions that prevent safe and timely operation of a cutterhead dredge to restore safe passage in the most expeditious manner, (b) lack of cutterhead dredge availability, (c) unacceptable cutterhead dredge mobilization/start-up response time, (d) excess project cost, and (e) inadequate estimated or actual cutterhead dredging production rates.

4. The Calcasieu River and Pass navigation channel and bar channel (miles 0.0 to -32.0, with the majority of dredging occurring between mile 0.0 to -10.0): Maintenance dredging is required for 2-3 months per year. During FY 2004, this project is scheduled to begin November 2003 and take approximately 60-90 days to remove eight million CY of material (9% sand, 45% silt, 46% clay) and maintain the 40-ft x 400-ft channel between jetties and the 42-ft x 800-ft channel to the 42-ft contour depth in the Gulf. The proposed disposal method is open water disposal at the ocean dredged material disposal sites located from mile 0 to mile -32.0 alongside the channel.

No sea turtle takes have ever been reported from the MR-SWP. A habitat characterization study conducted in 1996 by the New Orleans District COE, including endangered species observer deployment from April through November 1996, indicates that the strength and speed of the Mississippi River's current in Southwest Pass, which causes severe shoaling and resultant constant dredging demand, also preclude the establishment of benthic communities of sea turtle forage species. On January 17, 1997, NOAA Fisheries agreed with the New Orleans District COE's study assessment that sea turtles were not likely to occur within the Southwest Pass of the Mississippi River, and notified the new Orleans District COE that further deployment of sea turtle deflecting dragheads and sea turtle observers in Southwest Pass was unnecessary as the habitat is believed to be unsuitable for sea turtles. NOAA Fisheries has no new evidence that would alter the conclusions of the previous assessment.

The Atchafalaya River and Bayous Chene, Boeuf, and Black are dredged for about 40 days each annually, usually by cutterhead, and between 2-3 million CY of mostly sand (80% sand; 20 % silt) is removed to maintain a channel 20 feet wide by 400 feet long. The project area includes both a bay and a bar channel. A hopper dredge was first used during 2002 (January 30-February 9) in an attempt to better remove "fluff." "Fluff" is fluid mud that returns to channel shortly after dredging and interferes with the passage of certain types of vessels. NOAA Fisheries is not aware of any previously documented take of either sea turtles or Gulf sturgeon during dredging in this channel. Hopper dredging may again occur at these locations in the future.

Galveston District

Hopper dredges are used for maintenance dredging in the Galveston District channels listed below. To date, all beach nourishment projects in the Galveston District have been with dredge materials associated with channel dredging (i.e., sand mining sites were not used) and Galveston District does not anticipate any change to this scenario (Hauch, e-mail comm. to Hawk, Nov. 15, 2000). Hopper dredges deployed since May 1995 have had 100% observer coverage, 100% inflow/overflow screening, rigid deflector dragheads, and dragarm operators have attempted to disengage dredge pumps when dragheads were suspended in the water column. Galveston District also attempts to schedule all hopper dredging during the December 1- March 31 recommended window. During FY02, four maintenance hopper dredging projects were completed: Port Mansfield Channel and Brazos Island Harbor, March; Freeport Harbor, July-August; and Sabine-Neches Waterway, July-August. During FY2003, maintenance dredging was accomplished at Brownsville Entrance Channel (December) and Aransas Pass (April-July).

The COE Galveston District has identified the following channels where maintenance dredging is or will be required and use of hopper dredges is anticipated.

1. The Sabine-Neches Waterway: Annual maintenance dredging is required in this channel, conducted by both contract and government-owned hopper dredges. In FY2003, the COE plans to commence dredging in May for about three months. The last reported takes in this waterway were a Kemp's ridley in March 1997, and a loggerhead in August 2002 during COE dredging of 2.88 million CY of material from July 27-August 13, 2002.

2. Galveston Harbor and Channel: This project was subsumed by the Houston-Galveston Navigation Channels (H-GNC) widening and deepening project which was the subject of a December 7, 1998, Opinion (F/SER/1998/00010). Although incidental take associated with *new material* dredging (i.e., non-maintenance type dredging such as widening and deepening) at H-GNC is covered by the Incidental Take Statement of the December 7, 1998, Opinion, regular maintenance dredging will be required at the Entrance Channel with Extension, Outer Bar Channel, Inner Bar Channel, Bolivar Roads Channel, and the Anchorage Basin and is included in the present Opinion. Authorized channel dimensions are: Entrance Channel (49 ft by 800-1,239 ft); Outer Bar Channel (47-49 ft by 800-1,239 ft); Inner Bar Channel (47 ft by 800-1,189 ft); Bolivar Roads Channel (47 ft by 800-1,000 ft); and Anchorage Basin (36 ft by 2,870-9,760 ft). The total length of these channels is 76,000 feet. Frequency of dredging along this project is expected to average approximately 1.5 years. Although it is not presently known what shoaling patterns will emerge, if the entire project were to be maintained under a single contract, approximately 3.5 million CY of material would need to be excavated requiring about six months of dredging. A more reasonable expectation would be that the project would be broken down into sections that would be dredged with varying frequencies. Maintenance operations will be performed by either contract or

government-owned hopper dredges. One Kemp's ridley and one green were taken during FY99 and one Kemp's ridley was taken in FY2003 in H-GNC dredging. The Houston-Galveston Entrance and Jetty Channel dredging work was scheduled to begin in June 2003 and continue for about three months. In addition, the Galveston District reinitiated consultation with NOAA Fisheries on December 3, 2002, on new material dredging for a proposed new barge channel within the H-GNC system but not considered by the December 7, 1998, Opinion. NOAA Fisheries completed consultation informally on the barge channel dredging (I/SER/2002/01438) on December 8, 2003, since non-hopper type dredges will be used.

3. Freeport Harbor: Dredging frequency has increased since the last consultation, from annual to biannual maintenance dredging by contract hopper requiring about two months of work. The average volume of material removed per contract has increased to about 1.6 million CY. A total of eight sea turtles (all loggerheads) has been taken at this site: one in October 1995, four in June-July 1996, one in October 1998, and two in August 2000. The COE dredged 2.0 million CY of material from July 13-September 24, 2002. FY03 dredging is scheduled to start in June 2003, for about four months.

4. Matagorda Ship Channel: Maintenance dredging is conducted for about 1.5 months every four years using contract hopper dredge. The last lethal take at this site was a loggerhead in October 1996.

5. Corpus Christi Ship Channel: Maintenance dredging is conducted every 1.5 years by contract or government-owned hopper dredge and requires approximately two months. One loggerhead was lethally taken during clean-up in the Port Aransas entrance channel area in September1995; three additional turtles (all loggerheads) were lethally taken in June 1999. Aransas Pass Entrance Channel dredging began in April 9, 2003 and was completed on July 7, 2003, after moving ca 1,153,000 CY of material. Four loggerheads and one Kemp's ridley turtle were taken by the dredge during the project; 71 turtles (55 loggerheads, 15 Kemp's ridleys, and one leatherback) were safely removed from the action area by relocation trawlers.

6. Corpus Christi Ship Channel Improvement Project: Deepening of the Corpus Christi Ship Channel and nearshore approaches to Corpus Christi Bay from about 6 miles offshore. The proposed deepening of the Corpus Christi Shipping Channel (CCSC) from Viola Basin in the Inner Harbor to the end of the jetties in the Gulf of Mexico to –52 ft from –45 ft mean low tide (MLT), plus advanced maintenance and allowable overdepth; deepening the remainder of the channel into the Gulf of Mexico to 54 ft (depths will be increased roughly 10,000 ft into the Gulf of Mexico to the –56 ft isobath); widening of the Upper bay and Lower Bay reaches (from Port Aransas to Harbor Bridge) to 530 ft (existing widths are 500 ft between Port Aransas and La Quinta Junction and 400 ft between La Quinta Junction and the Harbor Bridge); construction of 200-ft wide barge shelves (-12 ft MLT) on both sides of the ship channel from La Quinta Junction to the Harbor Bridge, across the Upper bay portion of the CCSC; and extending La Quinta Channel 7,200 ft to a depth of –40 ft MLT and a width of 400 ft and including a turning basin. It is estimated that approximately 40 million cubic yards of new work will require seven separate dredging contracts to complete. NOAA Fisheries completed formal consultation on this project, and issued an Incidental Take Statement, in December 2002. To date, no turtles have been taken. Any takes associated with future maintenance dredging associated with this project are included in the present Opinion's ITS.

7. Brazos Island Harbor (includes Brazos Santiago Pass - the Brownsville Entrance Channel): Maintenance dredging is conducted every two years by contract hopper dredge and requires approximately 1.5 months. Brazos was dredged in February 1995 and two green turtles and one Kemp's ridley were observed to be taken lethally. A Kemp's ridley and a loggerhead were lethally taken in late April and mid-June of 1997, respectively. Two greens were taken between mid-February and early March 1999. Two greens were taken in a 24-hour period between March 18-19, 2002, causing the COE to terminate the dredging before project completion. The dredge returned in December when waters

temperatures were slightly cooler. Two green turtles were taken between December 15-19, 2002, and work was again suspended due to the lethal takes.

8. Port Mansfield: Maintenance dredging is required every three years by hopper or pipeline dredge, except for the channel seaward of the jetties which requires approximately one month of hopper dredging during maintenance years. Dredging in FY02 occurred from March 4-20, 2002. The first ever reported takes at this site were March 19-20, 2002, when two green turtles were lethally taken within 24 hours. The COE decided to forego additional dredging during FY02 at this site since four of their five green turtles allotted for the COE fiscal year had been taken while two additional major navigation projects remain to be dredged (Freeport Harbor Entrance and Jetty Channels; Sabine Pass Outer Bar and Sabine Bank Channels).

Mobile District

The Mobile District COE has responsibility for civil works activities in the Florida Panhandle west of (but not including) the Aucilla River Basin (including the St. Marks River, Florida) to the Rigolets, Louisiana (up to but not including the Mississippi River). Hopper dredges are routinely used to maintain ocean bar and entrance pass channels leading from the Gulf of Mexico through passes between offshore barrier islands into Mobile Bay, Mississippi Sound, and Pensacola Bay. However, prior to the present Opinion, consultations with the Mobile District on hopper dredging activities were concluded informally every five years, as NOAA Fisheries did not believe until recently that protected species were likely to be impacted as COE observers aboard dredges in Mobile Bay in the early 1990s did not detect evidence of sea turtle entrainment (Henwood, pers. comm. 2002).

The COE Mobile District has identified the following channels in which regular maintenance dredging is required and use of hopper dredges is anticipated.

1. Gulfport Harbor, Mississippi: The Mississippi Sound portion of the project is maintained on a roughly 18-24 month basis. The Mississippi Sound portion of the channel (includes the Sound Channel, Gulfport Ship Channel, Commercial Small Craft Harbor Entrance Channel, and Anchorage Basin) is maintained by pipeline dredge, though the Anchorage Basin may be rarely dredged by hopper dredge. Average yearly dredged material removed from the Anchorage Basin has been about 376,000 CY. The Pass (Ship Island Pass bar channel) and the Gulf entrance channel are maintained on a 12-month basis. Prior to 1992, the majority of this material was removed by hopper dredge and placed in the ocean disposal sites; since 1992 the material from the bar channel has been removed by pipeline dredge and placed downdrift. About 400,000-450,000 CY are removed annually from each entrance channel (Pass and Gulf). The Gulf entrance channel is maintained by hopper dredge with the material placed in ocean sites located on either side of the entrance channel. Currently the Gulf Channel, Bar Channel, Sound Channel, and Gulfport Ship Channel are maintained at their authorized depths of 38, 38, 36, and 36 feet, respectively. The COE Mobile District has initiated a study to investigate potential improvements to the Gulfport Harbor project, including widening and deepening.

2. Pascagoula Harbor, Mississippi: The Mississippi Sound portion of this project is maintained on an 18-24 month basis, typically by pipeline dredge. On occasion, a hopper dredge is utilized within the Mississippi Sound, Bayou Casotte, and Pascagoula River portions of the navigation project, including Pascagoula Naval Station channels. The bar channels (includes the Gulf entrance channel and Horn Island Pass) are maintained on an approximate annual basis. The Pass portion of the project is maintained with a pipeline dredge; the Gulf entrance channel leading to the Pass, and the Horn Island impoundment basin, is usually maintained by hopper dredge with about 538,000 CY removed in each annual dredging cycle. Dredged material is typically disposed of in designated disposal areas alongside the entrance

channel within Mississippi Sound near the Pass, and just outside and southwest of the Pass in nearby designated offshore disposal areas.

3. Mobile Harbor, Alabama: Prior to 1986, all material from the Mobile Bay portion of the project (Mobile Harbor Channel) was dredged by pipeline and sidecast adjacent to the channel. Since 1986 this area (Mobile Bay Ship Channel) has been typically dredged annually by hopper dredge on a continuous basis. Theodore Ship Channel, located about mid-way down the Mobile Harbor Channel, is typically maintained by pipeline dredge but occasionally, when the required dredging is in the vicinity of the juncture with the Mobile Ship Channel, this area will be dredged by hopper dredge. Dredging of the entrance channel leading from the Gulf to Mobile Pass is typically on a 24-month basis. Due to the hydrodynamics of the Mobile Pass, very little dredging is required between Miles 30 and 34, which encompasses the Pass (bar channel) into Mobile Bay between Fort Morgan and Fort Gaines. However, required dredging in the southern portion of the project (Pass and Gulf entrance channel) is typically performed by deep-draft hopper dredges. Annually, an average of 6.1 million CY of material are dredged from Mobile Bay channels; 888,000 CY are dredged from the bar channel; and 1.2 million CY are dredged (by pipeline dredge) from Mobile River channels.

4. Orange Beach and Gulf Shores Beach Nourishment Project: The District has received a proposal from the cities of Orange Beach and Gulf Shores to nourish 11 miles of Gulf beaches, in four segments. The easternmost segment occupies 1.1 miles of Perdido Key from the Alabama/Florida state line westward to the Florida Point unit of Alabama Gulf State Park, Orange Beach, Alabama. The central segment occupies the western 3.6 miles of shoreline in Orange Beach and the eastern 1.9 miles of shoreline in the Gulf State Park, east of the park fishing pier. The western segment lies along 3.3 miles of west Gulf Shores, beginning approximately 0.25 mile west of the entrance to Little Lagoon. The final segment is approximately one mile in length and lies immediately west of the entrance to Little Lagoon in Gulf Shores. Segments 1, 2, and 3 will receive 50-100 cubic yards per linear foot of shoreline, which is expected to advance the shoreline over 200 feet seaward in most areas. Segment 4 is a dune restoration only; no more than 10 cubic yards of sand will be placed per linear foot of shoreline and all fill will be placed above the mean high tide line. A total of seven million cubic yards of sand would be dredged from four offshore sand mining sites. The sites are located approximately 1-3 miles offshore, between Gulf Highlands and Perdido Pass.

5. Pensacola Harbor, Florida: COE Mobile District is currently developing a long-term maintenance plan for civil works projects in Pensacola Bay. In the past COE Mobile District has not routinely maintained these civil works projects, instead they have typically acted as an agent for the U.S. Navy whose channel subsumes the Federal channel at Pensacola. Hopper dredge use is common in Pensacola Bay. The Pensacola Pass Channel (also called Perdido Key Pass) between Santa Rosa Island and Perdido Key has been dredged by pipeline and hopper dredge. Dredged materials are typically disposed of in a nearby designated disposal area just seaward and west of Pensacola Pass, alongside the entrance channel (Caucus Channel).

It is expected that occasional emergencies will arise necessitating limited hopper dredge use in Perdido Key Pass or Pensacola Harbor, including the Navy Channel, Inner Harbor Channel, and Approach Channels to accommodate national defense needs or to deal with unexpected, hazardous shoaling caused by major storms, floods, hurricanes, etc. An emergency hopper dredging project was required in Perdido Key Pass in 2000. NOAA Fisheries also consulted in February 2001 with the COE Jacksonville District, Regulatory Division on a U.S. Navy-requested emergency hopper dredging project to remove approximately 130,000 CY of sandy material from the entrance channel to the Pensacola Harbor and Pensacola Naval Air Station. Although this work requested by the U.S. Navy was under the regulatory responsibility of the Jacksonville District, it was actually performed by the Mobile District, which acted as the Navy's agent and was therefore responsible for obtaining all the required permits (e.g., a regulatory permit from the Jacksonville District, and a permit from the state of Florida). NOAA Fisheries recently completed a formal consultation with the Mobile District on dredging of Pensacola Pass in the U.S. Gulf of Mexico and the deposition of the dredging spoil in the littoral zone off Perdido Key to the west of Pensacola Pass by hopper dredge (F/SER/2003/00053; August 4, 2003). The COE Jacksonville District was the permitting authority; the Mobile District COE, acting as an agent for the U.S. Navy (specifically, Naval Air Station Pensacola), contracted for the hopper dredging/relocation trawling work.

The Mobile District began voluntarily putting endangered species observers on civil works hopper dredging projects within the District in late-summer 2002, following meetings and numerous discussions with NOAA Fisheries. Prior to this, observers were not routinely placed aboard hopper dredges within the District. The Mobile District to date has not required hopper dredges in their District to operate with sea turtle deflectors on their dragheads ("deflector dragheads"), citing lack of evidence of significant sea turtle presence in District waters, and also stating their belief that to prove this it is necessary to dredge without deflecting dragheads in order to gather unbiased evidence that sea turtles are not present in District waters. Hopper dredges operating in the District are required to have hopper inflow screening (4-inch mesh).

Jacksonville District (Florida West Coast - Aucilla River Basin, Florida to Key West, Florida)

Jacksonville District's civil works boundaries generally follow river basins and drainage areas rather than state lines. Jacksonville District is responsible for all of Florida, with the following two exceptions: Mobile District is responsible for the area west of the Aucilla River basin in Florida's panhandle, and Savannah District maintains the St. Mary's River watershed in northeast Florida except for the Fernandina entrance channel that is maintained by Jacksonville District. In addition, Jacksonville District is also responsible for the watersheds of the Suwannee, Withlacoochee, and Alapaha rivers in southern Georgia. Jacksonville District also constructs civil works projects in Puerto Rico and the U.S. Virgin Islands.

Of the numerous navigation projects along the Gulf coast under the Jacksonville District's purview, only the navigation channels in Tampa Bay and Charlotte Harbor are likely to be dredged by hopper dredge; however, there are several beach nourishment projects along the Gulf coast in Pinellas, Collier, Manatee, Sarasota, Escambia, and Lee Counties where hopper dredges may be used. Hopper dredges may be used in the larger nourishment projects where offshore sand mining sites are involved, including but not limited to the Johns Pass, Pass-a-Grille, Egmont Shoal, Estero Island, Pensacola Beach, Venice Beach, Pinellas County, and Lido Key sand mining areas. It is likely that new sand mining sites will soon be required, located, and identified as beach nourishment needs grow and old sites are depleted.

The COE Jacksonville District has identified the following channels and beach restoration projects in which regular maintenance dredging is required and use of hopper dredges is anticipated.

1. Tampa Harbor Navigation Project: Egmont Key (Tampa Bay Entrance Channel) is typically dredged every ten years, and was last dredged in the spring of 1997. Since 1995, three Kemp's ridleys and two loggerheads have been taken by hopper dredges maintaining Tampa Bay navigation channels.

2. St. Petersburg Harbor and Entrance Channel: Last dredged in fall of 2000, a pre-dredging risk assessment trawl survey over eight days (approximately 29 hours of trawling) in the proposed dredging area resulted in capture, tagging, and relocation of two adult loggerheads and one subadult green turtle. Hopper dredging (September-October 2000) resulted in surface sightings of three turtles but no takes. Dredged material was used for renourishment of Egmont Key beaches.

3. Boca Grande Pass (Charlotte Harbor Entrance Channel): Since 1992, the Pass has been dredged every 2-3 years, with about 265,000 CY of shoal material removed during each dredging event. Maintenance dredging between October 20, 1998, and January 13, 1999, resulted in one loggerhead (non-lethal) take

and three loggerhead surface sightings within 300 yards of the operating hopper dredge. Dredged materials are typically used to renourish Gasparilla Island beaches.

The Jacksonville District COE has stated that the Boca Grande Pass will not likely require continued maintenance dredging. Although Florida Power and Light (FPL) previously maintained a coal-unloading pier on the southeast side of Gasparilla Island, which was used to offload coal-laden barges pulled by tugboats through the Pass, as a result of FPLs conversion from coal to natural gas, the dock is no longer utilized and therefore dredging is not required. Currently, the majority of boat traffic through the Pass consists of shallow draft recreational vessels. Nevertheless, economic and other considerations may at some point cause FPL to revert to coal, thus re-establishing COEs requirement to dredge the Pass for tugs and barge traffic.

4. Lido Key Shore Protection Project: Three proposed new sand mining areas located approximately 8-10 miles offshore have been identified for the project. Side scan sonar deployed near the sand mining areas provided some evidence of low-relief hardground communities. Sand mining areas will be designated to ensure that dredging will not occur within a minimum of 200 feet from any hardground area.

5. Lee County Shore Protection Project, Gasparilla and Estero Islands: The COE proposes to nourish 2.8 miles of shore on Gasparilla Island with approximately 803,000 CY of material from the Gasparilla Island sand mining area located in the Gulf approximately 3,000 feet offshore of the south end of Gasparilla Island; and 4.7 miles of shore on Estero Island with about 1,023,000 CY of material dredged from the Estero Island sand mining area located approximately 16 miles west of the island. Gasparilla Island would be renourished every seven years; Estero Island every three years.

6. Sarasota County, Manasota Key, Shore Protection Project: The Jacksonville District proposes to conduct a periodic renourishment of Venice Beach using sand taken from one or more of four sand mining sites located from 6-10 miles offshore of Venice Inlet. The proposed action, scheduled to commence in early-winter 2003 will last approximately 3-6 months and will involve placement of sand on 3.2 miles of shoreline using an estimated 800,000 to 1,000,000 cubic yards of material. Due to the distance to the mining sites, a hopper dredge may be used.

7. Pinellas County Shore Protection Project: This project has historically obtained beach quality fill from inlet borrow areas and the Egmont Channel Shoal for nourishment of Pinellas County beaches including, but not limited to, Sand Key, Long Key, and Treasure Island. To accommodate future nourishment needs, alternative mining sites which are closer to the beach fill sites have been identified. Nine new offshore mining sites located between 2-6 miles offshore of Pinellas County and four ebb-tidal shoals, as well as a segment of Egmont Channel Shoal and an area within Passe-a-Grille Channel, are being investigated.

8. Pensacola Beach Restoration Project: The COE Jacksonville District Regulatory Division initiated section 7 consultation with NOAA Fisheries and issued a regulatory permit to the Santa Rosa Island Authority to restore Pensacola Beach shoreline with approximately four million CY of sand dredged from an offshore (~3.5 miles) mining site with either a hopper or pipeline dredge, starting in winter 2002. A biological opinion (F/SER/2002/00091) issued by SERO on October 11, 2002, analyzed project effects and authorized potential takes associated with this project. The present Opinion only considers future periodic maintenance dredging requirements for the Pensacola Beach Restoration Project, <u>not</u> the placement of sand into designated critical habitat, once the initial restoration project is completed.

9. Alafia River Channel and Turning Basin Expansion (Hillsborough Harbor, Tampa Bay): The Alafia River Channel branches off from the main ship channel about 28 miles from the Gulf entrance, and

extends 3.6 miles easterly to terminals at the mouth of the Alafia River. It has an authorized depth of 32 feet Mean Lower Low Water (MLLW) over a bottom width of 200 feet. The turning basin has an authorized depth of 32 feet over a bottom area 700 feet wide and 1,200 feet long. The Tampa Port Authority desires to modify the existing project by deepening and widening the Federal channel and turning basin. In May 2002, the COE submitted an environmental assessment (EA) for a plan for expansion of the Alafia River channel and turning basin.

The preferred alternative in the EA involves widening the channel 50 feet to the south and deepening the channel to a project depth of 42 ft MLLW, and recommends that the turning basin be widened to provide a 1,200-ft diameter area at the channel depth of 42 feet. Disposal of dredged materials (approximately 5.5 million CY) would be at the designated Offshore Dredged Material Disposal site, with some material going into beneficial use areas. Although it is anticipated that material will be removed with a clamshell/scow operation, hopper dredge use is not excluded. Explosives will likely be used, therefore the COE will need to consult separately with NOAA Fisheries on that aspect of the project, since this Opinion only addresses use of hopper dredges.

10. Manatee Harbor (Port Manatee) Navigation and Berth Improvements (Phase 2): NOAA Fisheries received a draft EA on April 1, 2002, for the proposed work. The recommended plan includes construction of wideners along both the north and south sides of the channel at the intersection with the Tampa Harbor Channel, and construction of a 900-ft diameter turning basin at the eastern end of the Manatee Harbor Channel. The project features would be dredged to the existing authorized depth of 40 feet. NOAA Fisheries consulted with the COE on this project on December 22, 1999, concluding that no adverse effects were expected if hopper dredges were not used.

11. Stump Pass Channel Realignment and Beach Nourishment Project: The Charlotte County Board of County Commissioners, via regulatory permit from the COE's Jacksonville District, proposes to realign Stump Pass, at the southern tip of Manasota Key, from its current configuration to its 1980 configuration. The creation of a new channel will require dredging of approximately 500,000 CY of material of nearshore submerged areas in the Gulf of Mexico, beach dune, and inshore submerged areas in Lemon Bay. The newly-aligned channel will be 400 feet wide, 1 mile long. The 500,000 CY of spoil material will be placed on 2.7 miles of beach at two separate areas. The County proposes to periodically maintenance dredge Stump Pass' realigned channel (every 3-5 years) and deposit the spoil material on Don Pedro Island.

12. Naval Air Station Pensacola, Channel Maintenance Dredging: The Mobile District acted as an agent for the Navy to conduct maintenance hopper dredging operations in a portion of the Pensacola Channel in 2003, via regulatory permit issued by the COE's Jacksonville District. The hopper dredging activity was limited to a small area of the channel between Santa Rosa Island and Perdido Key, which is where the most shoaling has occurred. About 150,000-200,000 CY was dredged, with thin layer disposal in the littoral zone to the west of the Pensacola Pass and south of Perdido Key. NOAA Fisheries issued a biological opinion for this activity on August 4, 2003 (F/SER/2003/00053). Future maintenance dredging activities of this channel using hopper dredges are included in the present Opinion, but not dredge spoil deposition in Gulf sturgeon critical habitat.

Scheduling

The Galveston, New Orleans, Mobile, and Jacksonville Districts shall attempt to schedule hopper dredging operations between December 1 and March 31 ("hopper dredging window"), wherever feasible. A 1991 jeopardy Opinion to the COE's SAD on hopper dredging of southeastern U.S. channels first identified this window as necessary to minimize sea turtle interactions. Subsequent studies by the COE (Dickerson et al. 1994) in six southeastern channels suggested that the existing windows were accurate. Sea turtles are generally less abundant in coastal waters of both the Southeast and the Gulf of Mexico during this time period compared to other times of the year since water temperatures are coolest. However, it is unlikely that the COE Districts can schedule all of their hopper-dredging projects during this time frame due to the lack of availability of the hopper dredge fleet, safety considerations, and unforseen emergencies such as those created by hurricanes and flooding which may cause sudden, hazardous shoaling of navigation channels; therefore, projects may need to occur outside of the window. Hopper dredging priorities are developed by COE Districts that utilize these dredges along both the Atlantic and Gulf coasts. Priorities are determined after considering the dredging requirements, and resident sea turtle populations within the Districts. Additionally, shoaling patterns in some channels and bays (e.g., Freeport Harbor, Mobile Bay, MR-GO, and MR-SWP) preclude the option of dredging only during the cooler months.

Inflow Screen Mesh

Since 1995, all maintenance hopper dredges working in the Galveston, New Orleans, and Jacksonville Districts, and South Atlantic Districts, have been equipped with 100% inflow/overflow screening. The standard mesh size used during maintenance dredging operations is 4-inch by 4-inch. One hundred percent inflow screening is required, unless waived by NOAA Fisheries because it would otherwise be impossible to implement and still carry out the project, and 100% overflow screening is recommended. If conditions prevent 100% inflow screening, inflow screening may be reduced, but 100% overflow screening is then required. Whenever the clay or debris content of dredged materials causes excessive clogging, as verified by onboard endangered species observers, the COE consults with NOAA Fisheries and inflow screening is usually waived (often, inflow screen mesh size is gradually increased) until the substrate changes and clogging is no longer a problem. Whenever the inflow screening is removed due to potential clogging difficulties, 100% overflow screening is mandatory. Due to differences in overflow screen design, some hopper dredge vessels have overflow screens which are more efficient (i.e., easier to sample, more effective at retaining fragments of dismembered protected species) than others; e.g., horizontal overflow screens are much more efficient than vertical overflow screens. On the hopper dredge EAGLE 1, vertical overflow screening makes sampling for protected species' remains difficult and inconclusive.

For the Galveston District's H-GNC Entrance and Jetty Channels deepening and widening project, new material with high clay concentrations would be dredged. Taking this potential clogging problem into consideration, NOAA Fisheries' December 7, 1998, Opinion allowed successive modifications (increasing mesh size) to be made to hopper inflow screens if the standard 4-inch screens proved unworkable due to excessive clogging. NOAA Fisheries agreed that if the dredge operator, in consultation with observers and any onboard COE or NOAA Fisheries' personnel, determined that the draghead was clogging and reducing production substantially, the inflow screen mesh size could be gradually increased, and even eliminated entirely if necessary.

Occasionally, inflow screens are damaged by the pressure of the dredge slurry on the clogged mesh, requiring screens to be either opened or removed for repairs. When screens are removed, effective monitoring for sea turtle and sturgeon parts is not possible. As a result, COE Galveston District has suggested that in the present regional Opinion, a graduated mesh option–as was previously authorized for the H-GNC deepening and widening project–be authorized Gulf-wide. Graduated mesh would be permitted when clogging of the smaller mesh becomes excessive. Mesh size could then be increased incrementally. This provision for graduated mesh would allow better, more effective monitoring (compared to screen opening or removal), particularly in Freeport and Galveston channels where clogging is a problem during maintenance dredging.

3.0 Status of Listed Species and Critical Habitat

Much of the information for this section, as well as additional detailed information relating to the species biology, habitat requirements, threats, and recovery objectives, can be found in the recovery plan for each species (see "References Cited" section). The following listed species under the jurisdiction of NOAA Fisheries are known to occur in the Gulf of Mexico:

<u>Endangered</u>

Green sea turtle[3]	*Chelonia mydas*
Leatherback sea turtle	*Dermochelys coriacea*
Hawksbill sea turtle	*Eretmochelys imbricata*
Kemp's ridley sea turtle	*Lepidochelys kempii*
Sperm whale	*Physeter catodon*
Humpback whale	*Megaptera novaeangliae*
Fin whale	*Balaenoptera physalus*
Blue whale	*Balaenoptera musculus*
Sei whale	*Balaenoptera borealis*
Northern right whale	*Eubalaena glacialis*
Smalltooth sawfish	*Pristis pectinata*

<u>Threatened</u>

Loggerhead sea turtle	*Caretta caretta*
Gulf sturgeon	*Acipenser oxyrinchus desotoi*

<u>Critical Habitat</u>

Within the Gulf of Mexico, critical habitat has only been designated for the Gulf sturgeon.

Species Not Likely to Be Affected

Leatherback sea turtles (*Dermochelys coriacea*) are generally found in deep, pelagic, offshore waters though they occasionally may come into shallow waters to feed on aggregations of jellyfish. Leatherbacks are unlikely to be found associated with ship channels and thus are unlikely to be impacted by hopper dredging activity. There has only been one reported instance of a take of a leatherback sea turtle by a relocation trawler in a shipping channel, approximately 1.5 miles offshore of Aransas Pass, Texas (April 28, 2003, pers. comm. T. Bargo to E. Hawk), and there has never been a reported take by a hopper dredge. The typical leatherback turtle would be as large or larger than the large, industry-standard California-type hopper dredge draghead. Leatherback sea turtles will not be considered further in this Opinion based on the unlikelihood of their presence nearshore and their non-benthic feeding habits which combine to produce a very low likelihood of hopper dredge entrainment.

Smalltooth sawfish (*Pristis pectinata*) are tropical marine and estuarine fish that have the northwestern terminus of their Atlantic range in the waters of the eastern U.S. Currently, their distribution has contracted to peninsular Florida and, within that area, they can only be found with any regularity off the extreme southern portion of the state. The current distribution is centered in the Everglades National Park, including Florida Bay. They have been historically caught as bycatch in commercial and recreational fisheries throughout their historic range; however, such bycatch is now rare due to population declines and population extirpations. Between 1990 and 1999, only four documented takes of smalltooth

[3]Green turtles in U.S. waters are listed as threatened except for the Florida breeding population which is listed as endangered. Due to the inability to distinguish between these populations away from the nesting beach, green turtles are considered endangered wherever they occur in U.S. waters.

sawfish occurred in shrimp trawls in Florida (Simpendorfer 2000). After consultation with individuals with many years in the business of providing qualified observers to the hopper dredge industry to monitor incoming dredged material for endangered species remains (C. Slay, Coastwise Consulting, pers. comm. August 18, 2003) and a review of the available scientific literature, NOAA Fisheries has determined that there has never been a reported take of a smalltooth sawfish by a hopper dredge, and such take is unlikely to occur because of smalltooth sawfishes' affinity for shallow, estuarine systems. Only hopper dredging of Key West channels would have the potential to impact smalltooth sawfish but those channels are not considered in this Opinion. Therefore, NOAA Fisheries believes that smalltooth sawfish are rare in the action area, the likelihood of their entrainment is very low, and that the chances of the proposed action affecting them are discountable. This species will not be discussed further in this Opinion.

Sperm whales (*Physeter macrocephalus*) occur in the Gulf of Mexico but are rare in inshore waters. Other endangered whales, including North Atlantic right whales (*Eubalaena glacialis*) and humpback whales (*Megaptera novaeangliae*), have been observed occasionally in the Gulf of Mexico. The individuals observed have likely been inexperienced juveniles straying from the normal range of these stocks. NOAA Fisheries believes there are no resident stocks of these species in the Gulf of Mexico, and these species are not likely to be adversely affected by projects in the Gulf. NOAA Fisheries believes that blue, fin, or sei whales will not be adversely affected by hopper dredging operations; the possibility of dredge collisions is remote since these are deepwater species unlikely to be found near hopper dredging sites. There has never been a report of a whale taken by a hopper dredge. Based on the unlikelihood of their presence, feeding habits, and very low likelihood of hopper dredge interaction, the above-mentioned cetaceans are not considered further in this Opinion.

Species and Critical Habitat Likely to Be Affected

Of the above-listed threatened and endangered species of sea turtles, whales, and sturgeon potentially present in the action area, NOAA Fisheries believes that only loggerhead, green, hawksbill, and Kemp's ridley sea turtles, and Gulf sturgeon, are vulnerable to being taken as a result of the use of hopper dredges to maintain, or deepen and widen navigation channels and harbors, or to dredge sand mining areas for beach nourishment in the U.S. Gulf of Mexico. Hopper dredging activities also have the potential to destroy or adversely effect Gulf sturgeon critical habitat. Descriptions follow for each of these five species and for the designated critical habitat.

A. Species/critical habitat description

Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species on July 28, 1978. This species inhabits the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans, and within the continental United States it nests from Louisiana to Virginia. The major nesting areas include coastal islands of Georgia, South Carolina, and North Carolina, and the Atlantic and Gulf coasts of Florida, with the bulk of the nesting occurring on the Atlantic coast of Florida. Developmental habitat for small juveniles is the pelagic waters of the North Atlantic and the Mediterranean Sea (NMFS and USFWS 1991b).

Life history

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. There are five western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29° N; (2) a south Florida nesting subpopulation, occurring from 29° N on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez 1990 and TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS SEFSC 2001). The fidelity of nesting females to their nesting beach is the reason these subpopulations can be differentiated from one another. This nest beach fidelity will prevent recolonization of nesting beaches with turtles from other subpopulations.

Mating takes place in late March-early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern United States Individual females nest multiple times during a nesting season, with a mean of 4.1 nests/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 United States Atlantic and Gulf of Mexico. Benthic immature loggerheads (turtles that have come back to inshore and near shore 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.

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) estimates ages of maturity ranging from 20-38 years and benthic immature stage lasting from 14-32 years.

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 and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

Population dynamics and status

A number of stock assessments (TEWG 1998, TEWG 2000, and NMFS SEFSC 2001) have examined the stock status of loggerheads in the waters of the United States, but have been unable to develop any reliable estimates of absolute population size. Based on nesting data, of the five western Atlantic subpopulations, the south Florida nesting subpopulation and the northern nesting subpopulation are the most abundant (TEWG 2000 and NMFS SEFSC 2001). The Turtle Expert Working Group (TEWG) (2000) was able to assess the status of these two better-studied populations and concluded that the south Florida subpopulation is increasing, while no trend is evident (at that time considered stable but possibly declining) for the northern subpopulation. Another consideration adding to the vulnerability of the northern subpopulation is that NOAA Fisheries' scientists estimate that the northern subpopulation produces 65% males (NMFS SEFSC 2001).

The latest and most extensive stock assessment (NMFS SEFSC 2001) was successful in assembling the best available information on loggerhead turtle life history and developing population models that can be used to predict the response of the loggerhead populations to changes in their mortality and survival. The new turtle excluder device rule (68 FR 8456, February 21, 2003) requiring larger openings is expected to reduce trawl related loggerhead mortality by 94% (Epperly et al. 2002). Based on the loggerhead population models in NMFS SEFSC (2001) this change in the mortality rate is expected to move the northern nesting population from stable to increasing.

The southeastern United States nesting aggregation is second in size only to the nesting aggregation on islands in the Arabian Sea off Oman (Ross 1979, Ehrhart 1989, NMFS and USFWS 1991b). The southeast United States nesting aggregation is especially important because the status of the Oman colony has not been evaluated recently. 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 (Meylan et al. 1995).

Ongoing threats to the western Atlantic populations include incidental takes from dredging, commercial trawling, longline fisheries, and gill net fisheries; loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and disease.

<u>Green Sea Turtle</u>

Federal listing of the green sea turtle occurred on July 28, 1978, with all populations listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are endangered. The complete nesting range of the green turtle within the NOAA Fisheries' Southeast Region includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands between Texas and North Carolina and the Unite States Virgin Islands (U.S.V.I.) and Puerto Rico (NMFS and USFWS 1991a). Principal United States nesting areas for green turtles are in eastern Florida, predominantly Brevard through Broward Counties (Ehrhart and Witherington 1992). Green turtle nesting also occurs regularly on St. Croix, U.S.V.I., and on Vieques, Culebra, Mona, and the main island of Puerto Rico (Mackay and Rebholz 1996).

Life history

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, while 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.

Green turtle foraging areas in the southeastern United States include any coastal shallow waters having macroalgae or sea grasses near mainland coastlines, islands, reefs, or shelves, and any open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (Hirth 1997, NMFS and USFWS 1991a). Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty 1984, Hildebrand 1982, Shaver 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957, Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon System, Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward counties (Wershoven and Wershoven 1992, Guseman and Ehrhart 1992). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs. Age at sexual maturity is estimated to be between 20-50 years (Balazs 1982, Frazer and Ehrhart 1985).

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 few data are available.

Population dynamics and status

The vast majority of green turtle nesting within the southeastern United States occurs in Florida (Meylan et al. 1995, Johnson and Ehrhart 1994). Marine turtle populations have been monitored on Florida nesting beaches for nearly four decades. Currently, the Florida Wildlife Commission (FWC) coordinates the collection of nesting survey data on 180 survey areas comprising 1,300 km of nesting beach. Thirty-three of these beaches, chosen to represent the state geographically, participate in FWC's Index Nesting Beach Survey Program by following a standardized methodology for data collection that allows for statistically valid trend evaluation. It is unclear how greatly green turtle nesting in the whole of Florida has been reduced from historical levels (Dodd 1981). However, based on 1989-2002 nesting information, green turtle nesting in Florida has been increasing (Florida Marine Research Institute Statewide Nesting 2002, Database). Total nest counts and trends at index[4] beach sites during the past decade suggest that green turtles that nest within the southeastern United States are increasing.

There are no reliable estimates of the number of immature green turtles that inhabit coastal areas (where they come to forage) of the southeastern United States. However, information on incidental captures of immature green turtles at the St. Lucie Power Plant (average 215 green turtle captures per year since 1977) in St. Lucie County, Florida (on the Atlantic coast) indicates that the annual number of immature green turtles captured has increase significantly in the past 26 years (FPL 2002). At the power plant, the annual number of immature green turtle captures has increased significantly in the past 26 years. It is not known whether or not this increase is indicative of local or Florida east coast populations.

It is likely that immature green turtles foraging in the southeastern United States come from multiple genetic stocks; therefore, the status of immature green 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. Trends at Florida beaches are presented above. Trends in nesting at Yucatán beaches cannot be assessed because of a lack of consistent beach surveys over time. Trends at Tortuguero (ca. 20,000-50,000 nests/year) show a significant increase in nesting during the period 1971-1996 (Bjorndal et al. 1999). Therefore, it seems reasonable that there is an increase in immature green turtles inhabiting coastal areas of the southeastern United States; however, the magnitude of this increase is unknown.

The principal cause of past declines and extirpations of green turtle assemblages has been the over-exploitation of green turtles for food and other products. Although intentional take of green turtles and their eggs is not extensive within the southeastern United States, green turtles that nest and forage in the region may spend large portions of their life history outside the region and outside United States jurisdiction, where exploitation is still a threat. However, there are still significant and ongoing threats to green 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 fishing gear. There is also the increasing threat from occurrences of green 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).

Kemp's Ridley Sea Turtle

---

[4]Indexed beaches are those where survey effort to monitor annual nesting has been standardized and is constant from year to year and therefore nesting trends may be determined with statistical confidence; at non-indexed beaches, survey effort may, and often does, vary from year to year.

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. The 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

Females return to their nesting beach about every two 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.

Benthic immature Kemp's ridleys have been found along the east coast Seaboard of the United States and in the Gulf of Mexico. In the Atlantic, benthic immature turtles travel northward as the water warms to feed in the productive, coastal offshore waters (Georgia through New England), migrating southward with the onset of winter (Lutcavage and Musick 1985, Henwood and Ogren 1987, Ogren 1989). In the Gulf, 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). Little is known of the movements of the post-hatching stage (pelagic stage) within the Gulf. 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). The TEWG (1998) estimates age at maturity from 7-15 years.

Stomach contents of Kemp's ridleys taken from the lower Texas coast consisted of mainly nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards (Shaver 1991). 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, recent observations of increased nesting (with 6,277 nests recorded in 2000) suggest that the decline in the ridley population has stopped and the population is now increasing (USFWS 2000).

A period of steady increase in benthic immature Kemp's ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature turtles beginning in 1990. The increased survivorship of immature turtles is due in part to the introduction of turtle excluder devices (TEDs) in the United States and Mexican shrimping fleets. As demonstrated by nesting increases at the main nesting sites in Mexico adult Kemp's ridley numbers have grown. The population model used by TEWG (2000) projected that Kemp's ridleys could reach the intermediate recovery goal identified in the Recovery Plan, of 10,000 nesters by the year 2015.

The largest contributor to the decline of the Kemp's ridley in the past was commercial and local exploitation, especially poaching of nests at the Rancho Nuevo site, as well as the Gulf of Mexico shrimp trawl fisheries. The advent of TED regulations for trawlers and protections for the nesting beaches have 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.

Hawksbill Sea Turtle

The hawksbill turtle was listed as endangered on June 2, 1970, and is considered Critically Endangered by the International Union for the Conservation of Nature (IUCN). The hawksbill is a medium-sized sea turtle with adults in the Caribbean ranging in size from approximately 62.5 to 94.0 cm straight carapace length. The species occurs in all ocean basins although it is relatively rare in the Eastern Atlantic and Eastern Pacific, and absent from the Mediterranean Sea. Hawksbills are the most tropical of the marine turtles, ranging from approximately 30°N to 30°S. They are closely associated with coral reefs and other hard-bottom habitats, but they are also found in other habitats including inlets, bays and coastal lagoons (NMFS and USFWS 1993).

Life History

There are five regional nesting populations with more than 1,000 females nesting annually. These populations are in the Seychelles, Mexico, Indonesia, and two in Australia (Meylan and Donnelly 1999). Reproductive females undertake periodic (usually non-annual) migrations to their natal beach to nest. Movements of reproductive males are less well known, but are presumed to involve migrations to the nesting beach or to courtship stations along the migratory corridor (Meylan 1999b). Females nest an average of 3-5 times per season (Meylan and Donnelly 1999, Richardson et al. 1999). Clutch size is higher on average (up to 250 eggs) than that of other turtles (Hirth 1980). Reproductive females may exhibit a high degree of fidelity to their nest sites.

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

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

Population Dynamics, Status, and Distribution

There has been a global population decline of over 80% during the last three generations (105 years) (Meylan and Donnelly 1999).

In the Western Atlantic, the largest hawksbill nesting population occurs in the Yucatán Península of Mexico, where several thousand nests are recorded annually in the states of Campeche, Yucatán, and Quintana Roo (Garduño-Andrade et al. 1999). Important but significantly smaller nesting aggregations are documented elsewhere in the region in Puerto Rico, the U.S. Virgin Islands, Antigua, Barbados, Costa Rica, Cuba, and Jamaica (Meylan 1999a). Estimates of the annual number of nests for each of these areas are of the order of hundreds to a few thousand. Nesting within the southeastern U.S. and U.S. Caribbean is restricted to Puerto Rico (>650 nests/yr), the U.S. Virgin Islands (~400 nests/yr), and, rarely, Florida (0-4 nests/yr)(Eckert 1995, Meylan 1999a, Florida Statewide Nesting Beach Survey database 2002). At the two principal nesting beaches in the U.S. Caribbean where long-term monitoring has been carried out, populations appear to be increasing (Mona Island, Puerto Rico) or stable (Buck Island Reef National Monument, St. Croix, USVI) (Meylan 1999a).

Gulf Sturgeon

NOAA Fisheries and the FWS listed the Gulf sturgeon, also known as the Gulf of Mexico sturgeon, as a threatened species on September 30, 1991 (56 CFR 49653). The present range of the Gulf sturgeon extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi east to the Suwannee River in Florida. Sporadic occurrences have been recorded as far west as the Rio Grande River between Texas and Mexico, and as far east and south as Florida Bay (Wooley and Crateau 1985, Reynolds 1993).

Life history

The Gulf sturgeon is an anadromous fish; adults spawn in freshwater then migrate to feed and grow in estuarine/marine habitats. After spawning in the upper river reaches, both adult and subadult Gulf sturgeon migrate from the estuaries, bays, and the Gulf of Mexico to the coastal rivers in early spring (i.e., March through May) when river water temperatures range from 16 to 23°C (Huff 1975, Carr 1983, Wooley and Crateau 1985, Odenkirk 1989, Clugston et al. 1995, Foster and Clugston 1997, Fox and Hightower 1998, Sulak and Clugston, 1999, Fox et al. 2000). Fall downstream migration from the river into the estuary/Gulf of Mexico begins in September (at water temperatures around 23°C) and continues through November (Huff 1975, Wooley and Crateau 1985, Foster and Clugston 1997).

Most subadult and adult Gulf sturgeon spend cool months (October or November through March or April) in estuarine areas, bays, or in the Gulf of Mexico (Odenkirk 1989, Foster 1993, Clugston et al. 1995, and Fox et al. 2002). Research indicates that in the estuary/marine environment both subadult and adult Gulf sturgeon show a preference for sandy shoreline habitats with water depths less than 3.5 m and salinity less than 6.3 parts per thousand (Fox and Hightower 1998, Parauka et al. in press). The majority of tagged fish have been located in areas lacking seagrass (Fox et al. 2002, Parauka et al. in press), in shallow shoals 1.5 to 2.1 m and deep holes near passes (Craft et al. 2001), and in unvegetated, fine to medium-grain sand habitats, such as sandbars, and intertidal and subtidal energy zones (Menzel 1971, Abele and Kim 1986). These shifting, predominantly sandy, areas support a variety of potential prey items including estuarine crustaceans, small bivalve mollusks, ghost shrimp, small crabs, various polychaete worms, and lancelets (Menzel 1971, Abele and Kim 1986, AFS 1989, and M. Brim, USFWS pers. comm. 2002).

Once subadult and adult Gulf sturgeon migrate from the river to the estuarine/marine environment, having spent at least 6 months in the river fasting, it is presumed that they immediately begin foraging. Upon exiting the rivers, Gulf sturgeon are found in high concentrations near their natal river mouths; these lakes and bays at the mouth of the river are important because they offer the first opportunity for Gulf sturgeon to forage. Specifics regarding Gulf sturgeon diet items and foraging are discussed within Section IV (Effects of the Action) of this Opinion.

Gulf sturgeon are long-lived, with some individuals reaching at least 42 years in age (Huff 1975). Age at sexual maturity for females ranges from 8 to 17 years, and for males from 7 to 21 years (Huff 1975). Chapman et al. (1993) estimated that mature female Gulf sturgeon weighing between 29 and 51 kg produce an average of 400,000 eggs.

Based on the fact that male Gulf sturgeon are capable of annual spawning, and females require more than one year between spawning events (Huff 1975, Fox et al. 2000), we assume that the Gulf sturgeon are similar to Atlantic sturgeon (*A. o. oxyrhinchus*); that is, they exhibit a long inter-spawning period, with females spawning at intervals ranging from every 3 to 5 years, and males every 1 to 5 years (Smith 1985).

Spawning occurs in the upper river reaches in the spring when water temperature is around 15° to 20°C. While Sulak and Clugston (1999) suggested that sturgeon spawning activity is related to moon phase, other researchers have found little evidence of spawning associated with lunar cycles (Slack et al. 1999, Fox et al. 2000). Fertilization is external; females deposit their eggs on the river bottom and males fertilize them. Gulf sturgeon eggs are demersal, adhesive, and vary in color from gray to brown to black (Vladykov and Greeley 1963, Huff 1975, Parauka et al. 1991).

Genetic studies conclude that Gulf sturgeon exhibit river-specific fidelity. Stabile et al. (1996) analyzed tissue taken from Gulf sturgeon in eight drainages along the Gulf of Mexico for genetic diversity; they noted significant differences among Gulf sturgeon stocks, and suggested region-specific affinities and likely river-specific fidelity. Five regional or river-specific stocks (from west to east) have been identified: (1) Lake Pontchartrain and Pearl River, (2) Pascagoula River, (3) Escambia and Yellow Rivers, (4) Choctawhatchee River, and (5) Apalachicola, Ochlockonee, and Suwannee Rivers (Stabile et al. 1996).

Tagging studies also indicate that Gulf sturgeon exhibit a high degree of river fidelity (Carr 1983). Of 4,100 fish tagged, 21% (860/4100 fish) were later recaptured in the river of their initial collection, eight fish (0.009%) moved between river systems, and the remaining fish (78%) have not yet been recaptured (USFWS et al. 1995). There is no information documenting the presence of spawning adults in non-natal rivers. However, there is some evidence of inter-riverine (from natal rivers into non-natal) movements by both male and female Gulf sturgeon (n=22) (Wooley and Crateau 1985, Carr et al. 1996, Craft et al. 2001, Ross et al. 2001b, Fox et al. 2002). It is important to note that gene flow is low in Gulf sturgeon stocks, with each stock exchanging less than one mature female per generation (Waldman and Wirgin 1998).

A full discussion of the life history of this subspecies may be found in the September 30, 1991, final rule listing the Gulf sturgeon as a threatened species (56 FR 49653), the Recovery/Management Plan approved by NOAA Fisheries and the U.S. Fish and Wildlife Service in September 1995, and the final rule designating Gulf sturgeon critical habitat (68 FR 13370).

Population dynamics and status

Gulf sturgeon occur in most major tributaries of the northeastern Gulf of Mexico, from the Mississippi River east to Florida's Suwannee River, and in the central and eastern nearshore Gulf waters as far south as Charlotte Harbor (Wooley and Crateau 1985). In Florida, Gulf sturgeon are present in the Escambia, Yellow, Blackwater, Choctawhatchee, Apalachicola, Ochlockonee, and Suwannee Rivers (Reynolds 1993). While little is known about the abundance of Gulf sturgeon throughout most of its range, population estimates have been calculated for the Apalachicola, Choctawhatchee, and Suwannee Rivers. The USFWS calculated an average (from 1984-1993) of 115 individuals (> 45 cm TL) over-summering in the Apalachicola River below Jim Woodruff Lock and Dam (USFWS et al. 1995). Preliminary estimates of the Gulf sturgeon subpopulation in the Choctawhatchee River system are 2,000 to 3,000 fish over 61 cm TL. The Suwannee River Gulf sturgeon population (i.e., fish > 60 cm TL and older than age 2) has recently been calculated at approximately 7,650 individuals (Sulak and Clugston 1999). Although the size of the Suwannee River population is considered stable, the population structure is highly dynamic as indicated by length frequency histograms (Sulak and Clugston 1999). Strong and weak year classes coupled with the regular removal of larger fish (by natural mortality) limits the growth of the Suwannee River population but stabilizes the average population size (Sulak and Clugston 1999).

Gulf Sturgeon Critical Habitat

Gulf sturgeon critical habitat was jointly designated by the NOAA Fisheries and FWS in 2003 (68 FR 13370). Critical habitat is defined in section 3(5)(A) of the ESA as (i) the specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. "Conservation" is defined in section 3(3) of the ESA as the use of all methods and procedures that are necessary to bring any endangered or threatened species to the point at which listing under the ESA is no longer necessary.

Gulf sturgeon critical habitat includes areas within the major river systems that support the seven currently reproducing subpopulations (USFWS et al. 1995) and associated estuarine and marine habitats. Gulf sturgeon use the rivers for spawning, larval and juvenile feeding, adult resting, and staging, and to move between the areas that support these components. Gulf sturgeon use the lower riverine, estuarine, and marine environment during winter months primarily for feeding and, more rarely, for inter-river migrations. Estuaries and bays adjacent to the riverine units protect unobstructed passage of sturgeon from feeding areas to spawning grounds.

Fourteen areas (units) are designated as Gulf sturgeon critical habitat. Critical habitat units encompass approximately 2,783 river kilometers (rkm) and 6,042 km^2 of estuarine and marine habitats and include portions of the following Gulf of Mexico rivers, tributaries, estuarine and marine areas:

Unit 1 = Pearl and Bogue Chitto Rivers in Louisiana and Mississippi
Unit 2 = Pascagoula, Leaf, Bowie, Big Black Creek and Chickasawhay Rivers in Mississippi
Unit 3 = Escambia, Conecuh, and Sepulga Rivers in Alabama and Florida
Unit 4 = Yellow, Blackwater, and Shoal Rivers in Alabama and Florida
Unit 5 = Choctawhatchee and Pea Rivers in Florida and Alabama
Unit 6 = Apalachicola and Brothers Rivers in Florida
Unit 7 = Suwannee and Withlacoochee River in Florida
Unit 8 = Lake Pontchartrain (east of causeway), Lake Catherine, Little Lake, the Rigolets, Lake Borgne, Pascagoula Bay and Mississippi Sound systems in Louisiana and Mississippi, and sections of the state waters within the Gulf of Mexico
Unit 9 = the Pensacola Bay system in Florida
Unit 10 = Santa Rosa Sound in Florida
Unit 11 = Nearshore Gulf of Mexico in Florida
Unit 12 = Choctawhatchee Bay system in Florida
Unit 13 = Apalachicola Bay system in Florida, and
Unit 14 = Suwannee Sound in Florida

Critical habitat determinations focus on those physical and biological features (primary constituent elements = PCEs) that are essential to the conservation of the species (50 CFR 424.12). Federal agencies must insure that their activities are not likely to result in the destruction or adverse modification of the PCEs within defined critical habitats. Therefore, proposed actions that may impact designated critical habitat require an analysis of potential impacts to each PCE.

PCEs identified as essential for the conservation of the Gulf sturgeon consist of:

(1) Abundant food items, such as detritus, aquatic insects, worms, and/or molluscs, within riverine habitats for larval and juvenile life stages; and abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods,

molluscs and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages;

(2) Riverine spawning sites with substrates suitable for egg deposition and development, such as limestone outcrops and cut limestone banks, bedrock, large gravel or cobble beds, marl, soapstone, or hard clay;

(3) Riverine aggregation areas, also referred to as resting, holding, and staging areas, used by adult, subadult, and/or juveniles, generally, but not always, located in holes below normal riverbed depths, believed necessary for minimizing energy expenditures during fresh water residency and possibly for osmoregulatory functions;

(4) A flow regime (i.e., the magnitude, frequency, duration, seasonality, and rate-of-change of fresh water discharge over time) necessary for normal behavior, growth, and survival of all life stages in the riverine environment, including migration, breeding site selection, courtship, egg fertilization, resting, and staging, and for maintaining spawning sites in suitable condition for egg attachment, egg sheltering, resting, and larval staging;

(5) Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages;

(6) Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages; and

(7) Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., an unobstructed river or a dammed river that still allows for passage).

As stated in the final rule designating Gulf sturgeon critical habitat, the following activities, among others, when authorized, funded or carried out by a Federal agency, may destroy or adversely modify critical habitat:

(1) Actions that would appreciably reduce the abundance of riverine prey for larval and juvenile sturgeon, or of estuarine and marine prey for juvenile and adult Gulf sturgeon, within a designated critical habitat unit, such as dredging; dredged material disposal; channelization; in-stream mining; and land uses that cause excessive turbidity or sedimentation;

(2) Actions that would appreciably reduce the suitability of Gulf sturgeon spawning sites for egg deposition and development within a designated critical habitat unit, such as impoundment; hard-bottom removal for navigation channel deepening; dredged material disposal; in-stream mining; and land uses that cause excessive sedimentation;

(3) Actions that would appreciably reduce the suitability of Gulf sturgeon riverine aggregation areas, also referred to as resting, holding, and staging areas, used by adult, subadult, and/or juveniles, believed necessary for minimizing energy expenditures and possibly for osmoregulatory functions, such as dredged material disposal upstream or directly within such areas; and other land uses that cause excessive sedimentation;

(4) Actions that would alter the flow regime (the magnitude, frequency, duration, seasonality, and rate-of-change of fresh water discharge over time) of a riverine critical habitat unit such that it is appreciably impaired for the purposes of Gulf sturgeon migration, resting, staging, breeding site selection, courtship, egg fertilization, egg deposition, and egg development, such as impoundment; water diversion; and dam operations;

(5) Actions that would alter water quality within a designated critical habitat unit, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, such that it is appreciably impaired for normal Gulf sturgeon

behavior, reproduction, growth, or viability, such as dredging; dredged material disposal; channelization; impoundment; in-stream mining; water diversion; dam operations; land uses that cause excessive turbidity; and release of chemicals, biological pollutants, or heated effluents into surface water or connected groundwater via point sources or dispersed non-point sources;

(6) Actions that would alter sediment quality within a designated critical habitat unit such that it is appreciably impaired for normal Gulf sturgeon behavior, reproduction, growth, or viability, such as dredged material disposal; channelization; impoundment; in-stream mining; land uses that cause excessive sedimentation; and release of chemical or biological pollutants that accumulate in sediments;

(7) Actions that would obstruct migratory pathways within and between adjacent riverine, estuarine, and marine critical habitat units, such as dams, dredging, point-source-pollutant discharges, and other physical or chemical alterations of channels and passes that restrict Gulf sturgeon movement (68 FR 13399).

4.0 Environmental Baseline

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

Status of Species and Critical Habitat Within the Action Area

Sea Turtles

The species of sea turtles that occur in the action area and that might be affected by the proposed action are all highly migratory. The nearshore and inshore waters of the northern and eastern Gulf, including the upper Texas and Florida coast and estuaries such as Galveston Bay and Apalachee Bay, may be used by these species as post-hatchling developmental habitat or foraging habitat. NOAA Fisheries believes that no individual members of any of the species are likely to be permanent residents of the action area, although some individuals may be present at any given time, with minimum local abundance in winter and maximum local abundance in summer. These same individuals will migrate into offshore waters, as well as other areas of the Gulf of Mexico, Caribbean Sea, and North Atlantic Ocean when water temperatures drop and thus be impacted by activities occurring there; therefore, the species status is considered to be range-wide and supported by the species accounts in Section 2.0. Because they travel widely throughout the Atlantic, Gulf of Mexico, and Caribbean Sea, individuals in the action area are impacted by activities that occur in other areas within their geographic range.

Gulf Sturgeon

The Gulf sturgeon is found in the Gulf of Mexico primarily from Tampa Bay, Florida west to the mouth of the Mississippi River. The action area includes the entire geographic range of the species, all five genetically distinct Gulf sturgeon river-specific stocks, and winter habitat for all known (seven) reproducing riverine populations.

Gulf sturgeon will be present in the project area from about September through May; they are not likely to be present in the project area in the summer (approximately May to September) when they are upstream at spawning areas. Upstream migration from the estuarine/marine area to riverine spawning areas occurs in early spring (i.e., March through May) when river water temperatures range from 16° to 23°C (Huff 1975, Carr 1983, Wooley and Crateau 1985, Odenkirk 1989, Clugston et al. 1995, Foster and Clugston 1997, Fox and Hightower 1998, Sulak and Clugston 1999, Fox et al. 2000). Fall downstream migration from the river into the estuary/marine environment is cued by water temperature (around 23°C), generally beginning in September and continuing through November (Huff 1975, Wooley and Crateau 1985, Foster and Clugston 1997).

Gulf sturgeon use the lower riverine, estuarine, and marine environment from about September through May for feeding and migration. Following a period of fasting in the river, the Gulf sturgeon are presumed to begin foraging as soon as they enter suitable brackish and marine habitat; they have been located in seagrass and sand in depths of 1.5 to 5. 9 m (Fox and Hightower 1998, Craft et al. 2001, Parauka et al. in press) which supports a variety of potential prey items including estuarine crustaceans, small bivalve mollusks, and lancelets (Menzel 1971, Abele 1986, AFS 1989). In the estuarine/marine environment, Gulf sturgeon must consume sufficient prey to not only regain the body weight lost during the summer in the riverine environment, they must also obtain enough energy necessary for growth and reproduction (Fox et al. 2002, Murie and Parkyn pers. comm.). In addition to foraging, the Gulf sturgeon are migrating within the project area between habitats and, more rarely, between rivers.

Gulf Sturgeon Critical Habitat

NOAA Fisheries and FWS have designated 14 units as Gulf sturgeon critical habitat. Discussion in this Opinion will be limited to the marine/estuarine habitats (units #8-14) that are under the purview of NOAA Fisheries. The defining boundary between the riverine (FWS) and estuarine (NOAA Fisheries) units is rkm 0 (68 FR 13454). Regulatory jurisdiction in coastal areas extends to the line on the shore reached by the plane of the mean (average) high water (MHW) (33 CFR 329.12(a)(2)). All bays and estuaries within units #8-14, therefore, lie below the MHW lines. The term "72 COLREGS" delineates those waters where mariners shall comply with the International Regulations for Preventing Collisions at Sea, 1972 and those waters where mariners shall comply with the Inland Navigation Rules (33 CFR 80.01). The waters inside (landward) of these lines are Inland Rules waters and the waters outside (seaward) of the lines are COLREGS (International Rules) waters. These lines are defined in 33 CFR 80, and have been used for identification purposes to delineate boundary lines of the estuarine and marine habitat unit's 8, 9, 11, and 12. The following table, taken from the Gulf sturgeon critical habitat final rule (68 FR 13390), details areal coverage within each unit under NOAA purview.

Table 1. Approximate Area of the Estuarine and Marine Critical Habitat Units for the Gulf Sturgeon.

Critical Habitat Unit Estuarine and Marine Systems	State	Kilometers^2	Miles^2
# 8. Lake Borgne	Louisiana/	718	277
	Mississippi/	8	3
Little Lake	Alabama	763	295
Lake Pontchartrain		26	10
Lake St. Catherine		13	5
The Rigolets		1,879	725
Mississippi Sound		160	62
MS near shore Gulf			
#9. Pensacola Bay	Florida	381	147

Critical Habitat Unit Estuarine and Marine Systems	State	Kilometers²	Miles²
#10. Santa Rosa Sound	Florida	102	39
#11. Near shore Gulf of Mexico	Florida	442	171
#12. Choctawhatchee Bay	Florida	321	124
#13. Apalachicola Bay	Florida	683	264
#14. Suwannee Sound	Florida	546	211
Total		6,042	2,333

Individual critical habitat unit (#8-14 only) boundaries are summarized below and a functional description is provided.

Unit #8 (Lake Pontchartrain, Lake St. Catherine, The Rigolets, Little Lake, Lake Borgne, and Mississippi Sound) encompasses Lake Pontchartrain east of the Lake Pontchartrain Causeway, all of Little Lake, The Rigolets, Lake St. Catherine, and Lake Borgne, including Heron Bay, and the Mississippi Sound. Critical habitat follows the shorelines around the perimeters of each included lake. The Mississippi Sound includes adjacent open bays including Pascagoula Bay, Point aux Chenes Bay, Grand Bay, Sandy Bay, and barrier island passes, including Ship Island Pass, Dog Keys Pass, Horn Island Pass, and Petit Bois Pass. The northern boundary of the Mississippi Sound is the shoreline of the mainland between Heron Bay Point, Mississippi and Point aux Pins, Alabama. Critical habitat excludes St. Louis Bay, north of the railroad bridge across its mouth; Biloxi Bay, north of the U.S. Highway 90 bridge; and Back Bay of Biloxi. The southern boundary follows along the broken shoreline of Lake Borgne created by low swamp islands from Malheureux Point to Isle au Pitre. From the northeast point of Isle au Pitre, the boundary continues in a straight north-northeast line to the point one nautical mile (nmi) seaward of the western most extremity of Cat Island (30°13'N, 89°10'W). The southern boundary continues one nmi offshore of the barrier islands and offshore of the 72 COLREGS lines at barrier island passes (defined at 33 CFR 80.815 c)), (d) and (e)) to the eastern boundary. Between Cat Island and Ship Island there is no 72 COLREGS line. NOAA Fisheries has therefore defined that section of the unit southern boundary as one nmi offshore of a straight line drawn from the southern tip of Cat Island to the western tip of Ship Island. The eastern boundary is the line of longitude 88°18.8'W from its intersection with the shore (Point aux Pins) to its intersection with the southern boundary. The lateral extent of unit #8 is the MHW line on each shoreline of the included water bodies or the entrance to rivers, bayous, and creeks. Pascagoula Channel, a major shipping channel, as identified on standard navigation charts and marked by buoys, is excluded.

Unit #8 provides juvenile, subadult and adult feeding, resting, and passage habitat for Gulf sturgeon from the Pascagoula and the Pearl River subpopulations; fish are consistently located both inshore and around/between the barrier islands (i.e., Cat, Ship, Horn, and Petit Bois) within this unit (Reynolds 1993, Ross et al. 2001a, and Rogillio et al. 2002). Gulf sturgeon have also been documented within one nmi off the barrier islands of Mississippi Sound. Substrate in this unit range from sand to silt, all of which contain known Gulf sturgeon prey items, including lancelets (Menzel 1971, Abele and Kim 1986, American Fisheries Society 1989, Heise et al.1999b, Ross et al. 2001a, and Rogillio et al.2002). Four PCEs are present in critical habitat unit #8: abundant prey items for subadults and adults, water quality, sediment quality, and safe and unobstructed migratory pathways.

Unit #9 (Pensacola Bay) includes Pensacola Bay and its adjacent main bays and coves. These include Big Lagoon, Escambia Bay, East Bay, Blackwater Bay, Bayou Grande, Macky Bay, Saultsmar Cove, Bass Hole Cove, and Catfish Basin. The western boundary is the Florida State Highway 292 Bridge crossing Big Lagoon to Perdido Key. The southern boundary is the 72 COLREGS line between Perdido Key and Santa Rosa Island (defined at 33 CFR 80.810 (g)). The eastern boundary is the Florida State Highway 399 Bridge at Gulf Breeze, Florida. The lateral extent of unit #9 is the MHW line on each shoreline of the included waterbodies.

Unit #9 includes five interconnected bays, including Escambia Bay, Pensacola Bay, Blackwater Bay, East Bay, and the Santa Rosa Sound. The Santa Rosa Sound is addressed separately in unit #10. The Escambia River and its distributaries (Little White River, Dead River, and Simpson River) empty into Escambia Bay, including Bass Hole Cove, Saultsmar Cove, and Macky Bay. The Yellow River empties into Blackwater Bay. The entire system discharges into the Gulf of Mexico, primarily through a narrow pass at the mouth of Pensacola Bay.

Unit #9 provides winter feeding and migration habitat for Gulf sturgeon from the Escambia River and Yellow River subpopulations. Migratory movement is generally along the shoreline area of Pensacola Bay. During midwinter, sturgeon are commonly found in deep holes located north of the barrier island at Ft. Pickens, south of the Pensacola Naval Air Station, and at the entrance of Pensacola Pass; the depth in these areas ranges from 6-12.1 m. Four PCEs are present in critical habitat unit #9: abundant prey items for subadults and adults, water quality, sediment quality, and safe and unobstructed migratory pathways.

Unit #10 (Santa Rosa Sound) includes the Santa Rosa Sound, bounded on the west by the Florida State Highway 399 bridge in Gulf Breeze, Florida and the east by U.S. Highway 98 bridge in Fort Walton Beach, Florida. The northern and southern boundaries of unit #10 are formed by the shorelines to the MHW line or by the entrance to rivers, bayous, and creeks.

Unit #10 provides a continuous migratory pathway for Gulf sturgeon between Choctawhatchee Bay, Pensacola Bay and the Gulf of Mexico for feeding and genetic exchange (Wakeford 2001, Fox et al. 2002, and F. Parauka pers. comm. 2002). Gulf sturgeon from the Choctawhatchee, Escambia, and Yellow Rivers utilize unit #10 for migration and foraging. Four PCEs are present in critical habitat unit #10: abundant prey items for subadults and adults, water quality, sediment quality, and safe and unobstructed migratory pathways.

Unit #11 (Nearshore Gulf of Mexico): The western boundary is the line of longitude 87°20.0'W (approximately one nmi west of Pensacola Pass) from its intersection with the shore to its intersection with the southern boundary. The northern boundary is the mean high water (MHW) line of the mainland shoreline and the 72 COLREGS lines at passes as defined at 30 CFR 80.810 (a-g). The southern boundary of the unit is one nmi offshore of the northern boundary; the eastern boundary is the line of longitude 85°17.0'W from its intersection with the shore (near Money Bayou between Cape San Blas and Indian Peninsula) to its intersection with the southern boundary. Pensacola Channel, a major shipping channel, as identified on standard navigation charts and marked by buoys, is excluded.

Unit #11 includes winter feeding and migration habitat for Gulf sturgeon from the Yellow, Escambia, Blackwater, Choctawhatchee, and Apalachicola River subpopulations; the unit includes nearshore (1.6 km) waters from just west of Pensacola Pass to Money Bayou, Florida. Four PCEs are present in critical habitat unit #11: abundant prey items for subadults and adults, water quality, sediment quality, and safe and unobstructed migratory pathways.

Unit #12 (Choctawhatchee Bay): includes the main body of Choctawhatchee Bay, Hogtown Bayou, Jolly Bay, Bunker Cove, and Grassy Cove. The western unit boundary is the U.S. Highway 98 bridge at Fort

Walton Beach, Florida; the southern boundary is the 72 COLREGS line across East (Destin) Pass as defined at 33 CFR 80.810 (f). The lateral extent of unit #12 is the MHW line on each shoreline of the included water bodies.

Unit #12 provides important habitat for overwintering subadults and adults from the Yellow, Escambia, Blackwater and Choctawhatchee Rivers (USFWS 1997 and 1998, Fox et al. 2002, Parauka et al. in press). Four PCEs are present in critical habitat unit #12: abundant prey items for subadults and adults, water quality, sediment quality, and safe and unobstructed migratory pathways.

Unit #13 (Apalachicola Bay): includes the main body of Apalachicola Bay and its adjacent sounds, bays, and the nearshore waters of the Gulf of Mexico. The southern unit boundary includes water extending into the Gulf of Mexico one nmi from the MHW line of the barrier islands and from 72 COLREGS lines between the barrier islands (defined at 33 CFR 80.805 (e-h)); the western boundary is the line of longitude 85°17.0'W from its intersection with the shore (near Money Bayou between Cape San Blas and Indian Peninsula) to its intersection with the southern boundary. The eastern boundary of the unit is formed by a straight line drawn from the shoreline of Lanark Village at 29°53.1'N, 84°35.0'W to a point that is one nmi offshore from the northeastern extremity of Dog Island at 29°49.6'N, 84°33.2'W. The lateral extent of unit #13 is the MHW line on each shoreline of the included water bodies or the entrance of excluded rivers, bayous, and creeks.

Unit #13 provides winter feeding migration habitat for the Apalachicola River Gulf sturgeon subpopulation. Gulf sturgeon are believed to migrate from Apalachicola Bay into the Gulf of Mexico following prevailing currents and exiting primarily through the two most western passes (Indian and West) (Odenkirk, 1989). Four PCEs are present in critical habitat unit #13: abundant prey items for subadults and adults, water quality, sediment quality, and safe and unobstructed migratory pathways.

Unit #14 (Suwannee Sound): includes Suwannee Sound and a portion of adjacent Gulf of Mexico waters extending nine nmi from shore out to the State territorial water boundary. Its northern boundary is formed by a straight line from the northern tip of Big Pine Island (at approximately 29°23'N, 83°12'W) to the Federal-State boundary at 29°17'N, 83°21'W; the southern boundary is formed by a straight line from the southern tip of Richards Island (at approximately 29°11'N, 83°04'W) to the Federal-State boundary at 29°04'N, 83°15'W. The lateral extent of unit #14 is the MHW line along the shorelines and the mouths of the Suwannee River (East and West Pass), its tributaries and other rivers, creeks, or water bodies.

Unit #14 provides foraging habitat for Gulf sturgeon from the Suwannee River and a pathway for the fish to migrate from the river to the estuarine/marine environment. Four PCEs are present in critical habitat unit #14: abundant prey items for subadults and adults, water quality, sediment quality, and safe and unobstructed migratory pathways.

For the complete, legal description of Gulf sturgeon critical habitat unit boundaries, and a synopsis of biological information per unit, please refer to the final rule designating Gulf sturgeon critical habitat (68 FR 13370).

Factors Affecting the Species Environment Within the Action Area

As previously explained, sea turtles found in the action area are not year-round residents of the area, and may travel widely throughout the Atlantic, Gulf of Mexico, and Caribbean Sea. Therefore, individuals found in the action area can potentially be affected by activities anywhere else within their wide range of distribution.

Gulf sturgeon are present seasonally in a large portion of the project area; they are anadromous and spend the summer upriver at spawning habitat and the winter (about September through May) in estuarine/marine areas foraging and migrating. The action area includes the entire geographic range of the Gulf sturgeon and all habitats utilized for winter foraging and migration.

Gulf sturgeon critical habitat is found within the project area (from the Mississippi River east through the Suwannee Sound): seven of the 14 critical habitat units are within the project area and four of the seven PCEs may be impacted by the action. Upland activities could impact water quality in the unit.

1. Federal Actions

Sea Turtles

In recent years, NOAA Fisheries has undertaken several ESA section 7 consultations to address the effects of federally-permitted fisheries and other Federal actions on threatened and endangered sea turtles. Each of those consultations sought to develop ways of reducing the probability of adverse effects of the action on sea turtles. Similarly, recovery actions NOAA Fisheries has undertaken under the ESA are addressing the problem of takes of sea turtles in both the fishing and oil and gas industries, and vessel operations. The following summary of anticipated sources of incidental takes of turtles includes only those Federal actions which have undergone formal section 7 consultation. The incidental takes authorized in the biological opinions completed on the following actions are described in Table 2.

Adverse effects on threatened and endangered species from several types of fishing gear occur in the action area. Efforts to reduce the adverse effects of commercial fisheries are addressed through the ESA section 7 process. Gillnet, longline, trawl gear, and pot fisheries have all been documented as interacting with sea turtles. For all of these fisheries for which there is a Federal fishery management plan (FMP) or for which any Federal action is taken to manage that fishery, impacts have been evaluated under section 7. Several formal consultations have been conducted on the following fisheries that NOAA Fisheries has determined are likely to adversely affect threatened and endangered species: American lobster, calico scallop trawl fishery, monkfish, dogfish, southeastern shrimp trawl fishery, northeast multispecies, Atlantic pelagic swordfish/tuna/shark, and summer flounder/scup/black sea bass fisheries.

The southeastern shrimp trawl fishery affects more turtles than all other activities combined (NRC 1990). On December 2, 2002, NOAA Fisheries completed the Opinion for shrimp trawling in the southeastern United States 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 is based, in part, on the Opinion's analysis that shows the revised TED regulations are expected to reduce shrimp trawl-related mortality by 94% for loggerheads and 97% for leatherbacks compared to trawl-related mortality under previous TED regulations, and on the fact that nesting in the southeastern United States for all species of sea turtles (and Rancho Nuevo, Mexico in the case of Kemp's ridleys), with the exception of the northern nesting population of loggerhead turtles, has been increasing. However, NMFS (SEFSC 2001) population projection models indicate that a 30% decrease in benthic loggerhead mortality from an expanded TED rule will cause an increase in the northern nesting population. The shrimp trawling Opinion can be found at the following Web site:

http://www.nmfs.noaa.gov/prot_res/readingrm/ESAsec7/Biop_shrimp_trawling.PDF

On June 14, 2001, NOAA Fisheries issued a jeopardy opinion for the Highly Migratory Species (HMS) fisheries off the eastern United States. The HMS Opinion found that the continued prosecution of the pelagic longline fishery in the manner described in the HMS FMP was likely to jeopardize the continued existence of loggerhead and leatherback sea turtles. This determination was made by analyzing the effects of the fishery on sea turtles in conjunction with the environmental baseline and cumulative effects (for loggerheads this determination was based on the effects on the northern nesting population). The environmental baseline section of the HMS Opinion is incorporated herein by reference and can be found at the following NOAA Fisheries Web site:

http://www.nmfs.noaa.gov/prot_res/readingrm/ESAsec7/HMS060801final.pdf

NOAA Fisheries has implemented a reasonable and prudent alternative (RPA) in the HMS fishery which would allow the continuation of the pelagic longline fishery without jeopardizing the continued existence of loggerhead and leatherback sea turtles. The provisions of this RPA include the closure of the Grand Banks region off the northeastern United States and gear restrictions that are expected to reduce the bycatch of loggerheads by as much as 76% and of leatherbacks by as much as 65% compared to previously existing conditions. Further, NOAA Fisheries has implemented a major research project to develop measures aimed at further reducing longline bycatch. The implementation of this RPA reduces the negative effects that the HMS fishery has on the environmental baseline. The conclusions of the June 14, 2001, HMS Opinion and the subsequent implementation of the RPA are hereby incorporated into the environmental baseline section of this Opinion.

The environmental baseline for the June 14, 2001, HMS Opinion also considered the impacts from the North Carolina offshore spring monkfish gillnet fishery and the inshore fall southern flounder gillnet fishery, both of which were responsible for large numbers of sea turtle mortalities in 1999 and 2000, especially loggerhead sea turtles. However, during the 2001 season NOAA Fisheries implemented an observer program that observed 100% of the effort in the monkfish fishery, and then in 2002 a rule was enacted creating a seasonal monkfish gillnet closure along the Atlantic coast, based upon sea surface temperature data and turtle migration patterns. In 2001, NOAA Fisheries also issued an ESA section 10 permit to North Carolina with mitigative measures for the southern flounder fishery. Subsequently, the sea turtle mortalities in these fisheries were drastically reduced. Reinitiation of consultation for the summer flounder fishery has also begun. The reduction of turtle mortalities in these fisheries reduces the negative effects these fisheries have on the environmental baseline.

Potential adverse effects from Federal vessel operations in the action area and throughout the range of sea turtles include operations of the Navy (USN) and Coast Guard (USCG), the Environmental Protection Agency, the National Oceanic and Atmospheric Administration (NOAA), and the COE. NOAA Fisheries has conducted formal consultations with the USCG, the USN, and NOAA on their vessel operations. Through the section 7 process, where applicable, NOAA Fisheries 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.

In addition to vessel operations, other military activities including training exercises and ordnance detonation also affect sea turtles. Consultations on individual activities have been completed, but no formal consultation on overall USCG or USN activities in any region has been completed at this time.

Federally-funded and permitted projects to construct and maintain navigation channels have also been identified as a source of turtle mortality. Hopper dredges move relatively rapidly (compared to sea turtle swimming speeds) and can entrain and kill sea turtles, presumably as the drag arm of the moving dredge overtakes the slower moving turtle. Regional biological opinions (RBOs) for the COE have been completed for southeastern Atlantic waters (North Carolina through Florida), and Gulf of Mexico northern and western waters (Louisiana and Texas). The current Gulf-wide Opinion supersedes the latter RBO.

The COE and the Minerals Management Service of the Department of Interior (MMS) issue permits for oil and gas exploration, well development, production, and abandonment/rig removal activities that also may adversely affect turtles. Both these agencies have consulted with NOAA Fisheries on these activities which include the use of seismic arrays for oil and gas exploration in the Gulf of Mexico, the impacts of which have been addressed in Opinions for individual and multi-lease sales. Impacts are expected to result from vessel strikes, noise, marine debris, and the use of explosives to remove oil and gas structures.

Another action with Federal oversight (by the Federal Energy Regulatory Commission [FERC] or the Nuclear Regulatory Agency) which has impacts on sea turtles is the operation of electrical generating plants. Sea turtles entering coastal or inshore areas have been affected by entrainment in the cooling-water systems of electrical generating plants. Biological opinions have already been written for a number of electrical generating plants, and others are currently undergoing section 7 consultation.

Below is a table summarizing formal ESA section 7 consultations completed for Federal actions taking place in the southeastern United States that affect sea turtles:

Table 2. Summary of annual incidental take levels anticipated under the incidental take statements associated with NMFS' existing biological opinions in the U.S. Atlantic and Gulf of Mexico.

Federal Action	Annual Anticipated Incidental Take Level (lethal)[1]				
	Loggerhead	Leatherback	Green	Kemp's	Hawksbill
Coast Guard Vessel Operation	1(1)[2]	1(1)[2]	1(1)[2]	1(1)[2]	1(1)[2]
Navy-SE Ops Area[3]	91(91)	17(17)[2]	16(16)[2]	16(16)[2]	4(4)[2]
Navy-NE Ops Area	10(10)	0	1(1)[2]	1(1)[2]	0
Shipshock-Seawolf/Winston Churchill[4]	276(58)[2]	276(58)[2]	276(58)[2]	276(58)[2]	276(58)[2]
COE Dredging-NE Atlantic	27(27)	1(1)	6(6)[2]	5(5)[2]	0
COE Dredging-S. Atlantic	35(35)	0	7(7)	7(7)	2(2)
COE Dredging-N&W Gulf of Mexico	30(30)	0	8(8)	14(14)	2(2)
COE Dredging-E Gulf of Mexico	8 (8) [5]	5(5)[5]	5(5)[5]	5(5)[5]	5(5)[5]
COE Rig Removal, Gulf of Mexico	1(1)[2]	1(1)[2]	1(1)[2]	1(1)[2]	1(1)[2]
MMS Destin Dome Lease Sales	1(1)[2;6]	1(1)[2;6]	1(1)[2;6]	1(1)[2;6]	1(1)[2;6]

MMS 181 Lease Sales	1(1)[2;6]	1(1)[2;6]	1(1)[2;6]	1(1)[2;6]	1(1)[2;6]
MMS Rig Removal, Gulf of Mexico	10(10)[7]	5(5)[2;7]	5(5)[2;7]	5(5)[2;7]	5(5)[2;7]
NE Multispecies Sink Gillnet Fishery	10(10)	4(4)	4(4)	2(2)	0
ASMFC Lobster Plan	10 (10)	4(4)	0	0	0
Bluefish	6(3)	0	0	6(6)	
Herring	6(3)	1(1)	1(1)	1(1)	0
Mackerel, Squid, Butterfish	6(3)	1(1)	2(2)	2(2)	0
Monkfish Fishery[7]	6(3)	1(1)	1(1)	1(1)	0
Dogfish Fishery	6(3)	1(1)	1(1)	1(1)	0
Sargassum	30(30)[8]	1(1)[2]	1(1)[2]	1(1)[2]	1(1)[2]
Summer Flounder, Scup & Black Sea Bass	15(5)	3(3)[2]	3(3)[2]	3(3)[2]	3(3)[2]
Shrimp Fishery[9]	163,160 (3,948)	3,090 (80)	18,757 (514)	155,503 (4,208)	NA(640)[13]
Weakfish	20(20)	0	0	2(2)	0
HMS - Pelagic Longline Fishery[10]	468(7)	358(6)	46(2)	23(1)	46(2)
HMS - Shark gillnet Fishery[11]	20(20)	2(2)	2(2)	2(2)	2(2)
HMS - Bottom Longline Fishery[11]	12(12)	2(2)	2(2)	2(2)	2(2)
NRC – St. Lucie, FL[12]	1000[2] (10)[2]	1000[2] (1)	1000[2] (10)[2]	1000[2] (1)	1000[2] (1)
NRC – Brunswick, NC	50[2] (6)[2]	50[2]	50[2] (3)[2]	50[2] (2)[2]	50[2]
NRC – Crystal River, FL	55[2] (1)[2]	55[2] (1)[2]	55[2] (1)[2]	55[2] (1)[2]	55[2] (1)[2]
Total	**165,370 (4,346)**	**4,880 (197)**	**20,252 (656)**	**156,986 (4,348)**	**1,456 (835)**

[1]Anticipated Take level represents **'observed'** unless otherwise noted. Number in parenthesis represents lethal take and is a subset of the total anticipated take; numbers less than whole are rounded up.
[2] The anticipated take level may represent any combination of species and thus is tallied under each column.
[3] Includes Navy Operations along the Atlantic Coasts and Gulf of Mexico, Mine warfare center, Eglin AFB, Moody AFB
[4] Total **estimated** take includes acoustic harassment
[5]Up to 8 turtles total, of which, no more than 5 may be leatherbacks, greens, Kemp's or hawksbill, in combination.
[6]Total anticipated take is 3 turtles of any combination over a 30-year period
[7] Not to exceed 25 turtles, in total.
[8] Anticipated take for post-hatchlings for total period June 21, 1999 through January 2001
[9]Represents **estimated** take (interactions between turtles and trawls). Lethal take in parentheses.
[10] Represents **estimated** total take and **observed** lethal take in parentheses
[11] Represents **estimated** total and lethal take
[12] Annual incidental capture of up to 1,000 turtles, in any combination of the five species found in the action area. NMFS anticipates 1% of the total number of green and loggerhead turtles (combined) captured (i.e., if there are 900 total green and loggerhead turtles captured in one year, then 9 turtles in any combination of greens and loggerheads are expected to be injured or killed as a result. In cases where 1% of the total is not a whole number, then the total allowable incidental take due to injury or death will be rounded to the next higher whole number) will be injured or killed each year over the next 10 years as a result of this incidental capture. NMFS also anticipates two Kemp's ridley turtles will be killed each year and one hawksbill or leatherback turtle will be injured or killed every 2 years for the next 10 years.
[13] Actual mortalities of hawksbills, as a result of turtle/trawl interactions, is expected to be much lower than this number. This number represents the estimated total number of mortalities of hawksbill turtles from all sources in areas where shrimp fishing takes place.

Gulf Sturgeon and Gulf Sturgeon Critical Habitat

Incidental catch of Gulf sturgeon in both federally- and state-regulated fisheries has been documented. There have been incidental captures of Gulf sturgeon in the shrimp and gillnet fisheries in Apalachicola Bay (Swift et al. 1977, Wooley and Crateau 1985). Similar incidental catches have been reported in Mobile Bay, Tampa Bay, and Charlotte Harbor. Louisiana Department of Wildlife and Fisheries (LDWF) reported 177 Gulf sturgeon were incidentally captured by commercial fishermen in southeast Louisiana during 1992. Rogillio (September 20, 2002, pers. comm. to Eric Hawk, Gulf Sturgeon Workshop, University of Southern Mississippi, Hattiesburg, September 19-20, 2002) noted several recent instances of Gulf sturgeon takes by shrimpers operating off barrier island passes in Mississippi.

The operation of hydropower plants is a Federal action by FERC that has impacts on Gulf sturgeon. Sturgeon migrating up or down rivers and entering coastal and inshore areas can be affected by entrainment in the cooling-water systems; larvae may be adversely affected by heated water discharges. Dredging impacts associated with maintenance of hydropower and nuclear plants may affect both the Gulf sturgeon and its critical habitat.

The recent joint designation of Gulf sturgeon critical habitat by NOAA Fisheries and USFWS will benefit the species, primarily through the ESA section 7 consultation process. When critical habitat is designated, other Federal agencies are required to consult with NOAA Fisheries on actions they carry out, fund, or authorize, to ensure that their actions will not destroy or adversely modify critical habitat. In this way, a critical habitat designation will protect areas that are necessary for the conservation of the species. Designation of critical habitat may also enhance awareness within Federal agencies and the general public of the importance of Gulf sturgeon habitat and the need for special management considerations.

A designation of critical habitat also clarifies the section 7 consultation responsibilities for the Federal action agencies, particularly for projects where the action would not result in direct mortality, injury, or harm to individuals of the species. When critical habitat is designated, the action agency must consult - regardless of the seasonal presence or absence of the species - on actions that may affect critical habitat. Furthermore, the critical habitat designation describes the essential features of the habitat. Identifying the physical and biological features of each particular critical habitat area that are essential for species conservation assists agencies in identifying particular activities conducted outside the designated area that require section 7 consultation. For example, disposal of waste material in water adjacent to a critical habitat area may affect an essential feature (water quality) of the designated habitat and is therefore subject to the provisions of section 7.

Critical habitat designation also assists Federal agencies in planning future actions because it identifies, in advance, those habitats that will be given an additional review in section 7 consultations. This is particularly true in cases where two project areas exist and only one provides for the conservation of the species. With a designation of critical habitat, potential conflicts between Federal actions and listed species can be identified and possibly avoided early in the agency's process.

Federal agencies that consult on potential impacts to both Gulf sturgeon and its critical habitat include the Department of Defense (DOD), the COE, and the EPA. Dredging and dredged material disposal, and military activities including training exercises and ordnance detonation, have the potential to impact both the species and designated critical habitat. Numerous formal opinions have investigated project impacts to Gulf sturgeon; there has been a single formal opinion investigating impacts of dredge disposal on Gulf sturgeon critical habitat (NAS Pensacola). Numerous informal consultations with the DOD, COE, and EPA analyzing potential impacts to both Gulf sturgeon and its designated critical habitat have been conducted.

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

2. State or private actions

Sea Turtles

Commercial vessel traffic and recreational vessel pursuits can have an adverse effect on sea turtles through propeller and boat strike damage. Private vessels participate in high speed marine events concentrated in the southeastern United States and are a threat to sea turtles and marine mammals. The magnitude of these marine events is not currently known. NOAA Fisheries and the USCG (which permits these events) are in early consultation on these events, but a thorough analysis of impacts has not been completed.

Various fishing methods used in state fisheries, including trawling, pot fisheries, fly nets, and gillnets are known to cause interactions with sea turtles. Georgia and South Carolina prohibit gillnets for all but the shad fishery. Florida and Texas have banned all but very small nets in state waters. Louisiana, Mississippi, and Alabama have also placed restrictions on gillnet fisheries within state waters. Very little commercial gillnetting takes place in southeastern U.S. waters, with the exception of North Carolina. Most pot fisheries (turtles can get entangled in the lines in these fisheries) in the Southeast are prosecuted in areas frequented by sea turtles. Recreational angling, including bottom fishing for snapper, grouper, and other species in the Gulf of Mexico and southeastern waters, and fishing from private and public docks and piers, are known to occasionally take sea turtles by hooking and entanglement. NOAA Fisheries has consulted on potential sea turtle takes by fishermen on several federally-permitted public piers in Florida.

Gulf Sturgeon and Gulf Sturgeon Critical Habitat

A number of activities that may indirectly affect Gulf sturgeon and its critical habitat include discharges from wastewater systems, dredging, ocean dumping and disposal, and aquaculture. The impacts from these activities are difficult to measure. Where possible, however, conservation actions through the ESA section 7 process, ESA section 10 permitting, and state permitting programs, are being implemented to monitor or study impacts from these sources.

Increasing coastal development and ongoing beach erosion will result in increased demands by coastal communities, especially beach resort towns, for periodic privately-funded or federally-sponsored beach renourishment projects. These activities may affect Gulf sturgeon and its critical habitat by burying macroinvertebrates that occur in nearshore habitats that serve as foraging areas, in addition to the potential direct effect to the species by entrainment in dredge suction dragheads at the sand mining sites.

Increased groundwater withdrawal for irrigation in southwest Georgia may result in a 30% reduction of discharge to streams and thereby affect water quality and quantity. Reducing discharge decreases cool water habitats which are thought to offer sturgeon refugia from warm riverine water; recent droughts in the Apalachicola River basin have aggravated the loss of cool-water refugia; and spring-water intrusion into the Suwannee River during drought conditions changes ionic conductivity and water temperature unfavorably for embryonic development and larval success (Sulak and Clugston 1999).

3. Conservation and recovery actions shaping the environmental baseline

NOAA Fisheries has implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial fisheries. In particular, NOAA Fisheries has required the use of TEDs in southeastern U.S. shrimp trawls since 1989 and in summer flounder trawls in the mid-Atlantic area (south of Cape Charles, Virginia) since 1992. It has been estimated that TEDs are 97% efficient at excluding (releasing alive) 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. Recent analyses by Epperly and Teas (2002) indicate that the minimum requirements for the escape opening dimensions were too small, and that as many as 47% of the loggerheads stranding annually along the Atlantic Seaboard and Gulf of Mexico were too large to fit through existing openings. NOAA Fisheries recently published a final rule to require larger escape openings in TEDs used in the southeastern shrimp trawl fishery (68 FR 8456; February 21, 2003). Based upon the analyses in Epperly and Teas (2002), leatherback and loggerhead sea turtles will greatly benefit from the new regulations, with expected reductions of 97% and 94% (over the reduction expected with the old TEDs), respectively, in mortality from shrimp trawling.

In 1993 (with a final rule implemented in 1995), NOAA Fisheries established a Leatherback Conservation Zone to restrict shrimp trawl activities from the coast of Cape Canaveral, Florida, to the North Carolina/Virginia border. This provided for short-term closures when high concentrations of normally pelagic leatherbacks are recorded in near coastal waters where the shrimp fleet operates. This measure was necessary because, due to their size, adult leatherbacks were larger than the escape openings of most NOAA Fisheries-approved TEDs. With the implementation of the new TED rule requiring larger opening sizes on all TEDs, the reactive emergency closures within the Leatherback Conservation Zone are no longer necessary.

NOAA Fisheries is also working to develop a TED which can be effectively used in a type of trawl known as a fly net, which is sometimes used in the mid-Atlantic and northeastern fisheries to target sciaenids and bluefish. Limited observer data indicate that takes can be quite high in this fishery. A prototype design has been developed, and testing has been underway since December 2002.

In addition, NOAA Fisheries has been active in public outreach efforts to educate fishermen regarding sea turtle handling and resuscitation techniques. NOAA Fisheries recently conducted a number of workshops with longline fishermen to discuss bycatch issues including protected species, and to educate them regarding handling and release guidelines. NOAA Fisheries intends to continue these outreach efforts and hopes to reach all fishermen participating in the pelagic longline fishery over the next one to two years. An extensive network of Sea Turtle Stranding and Salvage Network participants along the Atlantic and Gulf of Mexico not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded turtles.

Commercial harvesting of Gulf sturgeon has been banned by all coastal states where the species is likely present (i.e., Florida, Mississippi, and Alabama). State actions eliminating or limiting gillnetting also benefit the Gulf sturgeon.

Federal Essential Fish Habitat consultation requirements pursuant to the Magnuson-Stevens Fishery Management and Conservation Act also minimize and mitigate for losses of wetlands, and preserve valuable foraging and developmental habitat for Gulf sturgeon.

5.0 Effects of the Action

A. Hopper Dredging Effects on Sea Turtles

It has been previously documented in NOAA Fisheries' biological opinions and the present Opinion that maintenance hopper dredging in three of the four COE Districts in the action area occasionally results in sea turtle entrainment and death, even with seasonal dredging windows, turtle deflector dragheads in place, and concurrent relocation trawling. For example, in the western Gulf of Mexico from February 1995 through September 2002, a total of 29 lethal takes was documented (six Kemp's ridleys, 15 loggerheads, and eight greens) by Galveston District hopper maintenance dredging activities (Appendix I).

In the northern Gulf of Mexico from May 1995 to mid-July 2003, a total of 39 lethal sea turtles takes (including 27 loggerheads, eight Kemp's ridleys, and four unidentified) was reported by the New Orleans District as taken by hopper dredges during maintenance dredging. Thirty-six of the takes (22 loggerheads) occurred in the MR-GO dredging area; three takes (two Kemp's ridleys) occurred in the Calcasieu Channel. 2001 was a year of unusually high loggerhead sea turtle abundance in the MR-GO based on take records since 1995; ten of the 11 turtle takes that occurred between April 24 and June 10, 2001 were loggerheads. Since October 2002, hopper dredging in the MR-GO has resulted in ten lethal loggerhead entrainments.

In the Jacksonville District (Florida west coast) since 1995, six turtles have been documented as entrained: three lethal Kemp's ridley takes, and three loggerhead takes (one non-lethal) during Tampa Bay and Charlotte Harbor dredging.

No sea turtle takes have yet been documented by the Mobile District in its hopper dredging projects; however, until late-summer of 2002, the District did not require observers or screening on its hopper dredges.

It can be expected that future hopper dredging in the Gulf of Mexico action area will occasionally take sea turtles, principally loggerheads, Kemp's ridleys, and greens, and may rarely take a hawksbill turtle, based upon this data on hopper dredging takes and on the information below regarding sea turtle distribution.

Satellite telemetry work funded by COE and conducted by NOAA Fisheries' Galveston Laboratory, demonstrates the nearshore occurrence of Kemp's ridleys near northern Gulf channels. Kemp's ridleys remained within ten nmi of shore for greater than 95% of the observed time, with 90% of the observed locations within five nmi (M. Renaud, NOAA Fisheries' Galveston Laboratory, pers. comm.). Movements out of northern Gulf waters in response to cooling temperatures occurred during December, and Kemp's ridleys returned with warming waters in March.

Seasonal abundance of sea turtles utilizing nearshore waters of the northwest Gulf of Mexico varies with species and location. Green turtles within subtropical habitats of the Laguna Madre are the regions's only year-round, inshore occupant. Other species, especially the Kemp's ridley, are transient users of the coastal zone that venture toward tidal passes and into bays during May-August when food sources and other environmental factors are favorable. The May-August period has yielded over 80% of the sea turtles captures (n=516) recorded by Texas A&M researchers (Landry et al. 1997). Based on strandings, reported incidental captures, observer data (Gulf and South Atlantic Foundation, and NMFS) aerial surveys (SETS, Pascagoula Oil Platform Association data, Gulf Of Mexico red drum surveys of 1987, 1995, and 1999, CETAP, SEAS92 and SECAS95, MATS95, GulfCet I, GulfCet II, and GoMex surveys), and telemetry tracks, loggerheads are distributed ubiquitously in the Gulf Area, generally occurring in all areas, inshore and offshore, and at all times when shrimp trawl activity is likely to occur. Shrimping occurs essentially year-round. (NOAA Fisheries' unpublished data, December 2002: Environmental Assessment/Regulatory Impact Review of Technical Changes to the Turtle Excluder Device (TED) Regulations to Enhance Turtle Protection in the Southeastern United States).

Anticipated Increase in Beach Restoration Activities

The COE has indicated that beach restoration activities, and consequent offshore sand mining often using hopper dredges, are likely to increase this decade in Gulf of Mexico coastal states. Sand mining sites are to some extent selected by the COE based on their absence of, or safe distance from, hardbottoms which in addition to attracting sea turtles may damage the dragheads, reduce production, and may also not provide sand with characteristics suitable for beach restoration efforts. NOAA Fisheries believes that sea turtles and Gulf sturgeon will occasionally be found at some sand mining sites (or dredged material disposal sites) in the Gulf of Mexico (e.g., Pinellas County, Lido Key, Lee County, and Sarasota County Shore Protection Projects), probably attracted to nearby nesting beaches, hardbottoms, artificial reefs, or other structures which contain foraging habitat for sea turtles, or passes between barrier islands where Gulf sturgeon are known to congregate and forage in winter (e.g., Horn Island Pass, Mississippi; Perdido Pass, Alabama; Pensacola Pass, Boca Grande Pass, and Stump Pass, Florida). NOAA Fisheries believes that dredging of sand at designated sites, proposed sites, or currently undiscovered mining sites near hardbottoms, or disposal of dredged materials near navigation channels and passes, may adversely affect listed species by hopper dredge entrainment and damage (by degradation or destruction) to foraging habitat in or in proximity to disposal or mining sites.

Disorientation Effects of Hopper Dredge and Pumpout Barge Deck Lighting

NOAA Fisheries believes that female sea turtles approaching nesting beaches and neonates (i.e., hatchlings) emerging from nests and exiting their natal beaches, may be adversely affected by bright offshore lights from hopper dredges or hopper dredge pumpout barges operating in the nearshore (0-3 nmi) environment. Females approaching the beach to nest could be deterred from nesting by bright lights in the nearshore environment. Hatchlings emerging from their nests could be attracted away from the shortest path to the water and instead crawl or swim toward the bright lights of a nearshore hopper dredge or anchored pumpout barge (instead of crawling or swimming seaward toward the open horizon), thus increasing their exposure time to predation. NOAA Fisheries recently received a report (M. Nicholas pers. comm. to E. Hawk, September 29, 2003) from a National Park Service biologist at Gulf Islands National Seashore) who relocated a clutch of 97 Perdido Key hatchlings on September 28, 2003. The biologist felt that the hatchlings were in danger of being attracted to a nearby operating, brightly lit hopper dredge which was dredging ½ to 1 mile offshore in Pensacola Entrance Channel. NOAA Fisheries considers it prudent that hopper dredges and hopper dredge pumpout barges operating within three nmi of sea turtle nesting beaches during sea turtle nesting and sea turtle hatchling emergence season (May 1-October 31, yearly), should shield essential deck lighting and reduce or extinguish non-essential deck lighting to the maximum extent possible consistent with vessel personnel safety and U.S. Coast Guard navigation requirements, to reduce potential disorientation effects, potential reduced or aborted nesting, and potential increased hatchling mortality from increased exposure to predators. This is consistent with U.S. Fish and Wildlife Service biological opinion requirements and Florida Wildlife Commission requirements for beach nourishment projects where nesting sea turtles may be present, and was jointly developed by these agencies, Florida Department of Environmental Protection, and the U.S. Army Corps of Engineers, Jacksonville District (Robbin Trindell, pers. comm. to Eric Hawk, September 30, 2003).

Sedimentation Effects
Efforts to reduce potential sedimentation damage to habitats adjacent to sand mining sites were incorporated into the 1995 SAD RBO, which recommended "water column sediment load deposition rates of no more than 200 mg/cm^2/day, averaged over a 7-day period, to protect coral reefs and hard bottom communities..." That measure will be carried forward in the Conservation Recommendations of the present Opinion. To reduce the possibility of listed species takes during sand mining activities, the terms and conditions of this Opinion will require that hopper dredges operating at offshore sand mining sites maintain a minimum distance of 400 feet from hardgrounds since these areas may attract sea turtles.

Notably, this Opinion includes only the hopper dredging of the aforementioned sand mining sites that do not occur within designated Gulf sturgeon critical habitat. This Opinion does not include any new sand mining site in designated critical habitat, nor the placement of sand in any littoral zone within designated critical habitat.

Sea Turtle Takes Associated with Sand Mining
Historically, sea turtle takes associated with sand mining activities for beach restoration, conducted using hopper dredges, have been few compared to channel dredging. In the South Atlantic, 11 loggerheads were taken from 1997-1999 at sand mining sites off Myrtle Beach, South Carolina (all of these takes occurred outside of the December 1-March 31 window). In North Carolina, two Kemp's ridleys and two loggerheads were taken in a single day at the Bogue Banks Restoration Project borrow site on December 21, 2001, apparently attracted to remains of an artificial, tire reef, and another Kemp's ridley was taken on April 11, 2002. In Florida's Brevard County, a loggerhead was taken at the Canaveral Shoals sand mining site on March 31, 2001, and another loggerhead was taken on February 19, 2002, at a nearby mining site. On March 19, 2003, a loggerhead sea turtle was taken during sand mining for the Bogue Banks Restoration Project (a relocation trawler moved five turtles out of the area between March 13-28). No other instances of hopper dredge takes at sand mining sites are known. There are no instances of takes yet recorded for sand mining activities in the Gulf of Mexico; these activities have been limited, sometimes have not been reported to NOAA Fisheries, and it is not known if observers have been present. However, NOAA Fisheries expects that future takes will occur in association with hopper dredge sand mining activities in the Gulf of Mexico.

Use of Bed-leveling Mechanical Dredging Devices
Bed-leveling is often associated with hopper dredging (and other types of dredging) operations. Bed-leveling "dredges" do not use suction and 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. Some evidence indicates that they may be responsible for occasional sea turtle mortalities (Mark Dodd, GADNR, unpublished data; July 2003 BA for Brunswick Harbor Deepening, Savannah District COE). Sea turtles may be crushed as the leveling device–which weighs about 30 to 50 tons and is typically fixed with cables to a derrick mounted on a barge pushed or pulled by a tugboat at about one to two knots–passes over and crushes a turtle which failed to move out of the way and is not pushed out of the way by the sediment wedge "wave" which generated by and moving ahead of the device. Sea turtles at Brunswick Harbor, Georgia may have been crushed and killed by recent bed-leveling "clean-up dredging" 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-level type dredges, they failed to react quickly enough to avoid the bed-leveler. Use of bed-levelers for cleanup operations, however, is probably preferable to use of hopper dredges since turtles which are foraging/resting/brumating on irregular bottoms are probably more likely to be entrained by suction dragheads because sea turtle deflector dragheads are less effective on uneven bottoms, hopper dredges move considerably faster than bed-leveler "dredges," and bed-levelers do not use suction.

B. <u>Hopper Dredging Effects on Gulf Sturgeon</u>

Dredge entrainment of Gulf sturgeon by hopper dredging has previously been assessed by NOAA Fisheries in section 7 consultations for channel maintenance. NOAA Fisheries had determined that the hopper dredge projects were not likely to adversely affect the species given either the projects' limited scope and/or the unlikely seasonal presence of Gulf sturgeon. While no Gulf sturgeon take by hopper dredges have been reported to date, allopatric sturgeon species on the Atlantic Seaboard have been taken occasionally by hopper dredge. Similarly, the existing RBO to the COE's South Atlantic Division for hopper dredging between North Carolina through Florida limits the incidental take to five shortnose sturgeon (*A. brevirostrum*). While NOAA Fisheries is unaware of any instances to date of Gulf sturgeon take by a hopper dredge, Atlantic sturgeon and shortnose sturgeon are occasionally taken by hopper dredges operating on the Atlantic seaboard (C. Slay, Coastwise Consulting, pers. comm. to E. Hawk; J. Crocker, October 15, 2003, pers. comm. to S. Bolden). Therefore, NOAA Fisheries considers it prudent to address potential Gulf sturgeon takes by hopper dredges operating in the Gulf of Mexico as we presume the species can be taken given the evidence from two morphologically and ecologically similar Atlantic sturgeon species.

While the probability of sea turtle take by hopper dredge is lessened by winter-time dredging (particularly when water temperatures are below 11°C), Gulf sturgeon are more likely to be present in estuarine and coastal waters, and passes between the barrier islands, during that period. Nevertheless, Gulf sturgeon may be more sensitive to vibrations transmitted along the bottom (by a noisy, approaching hopper dredge draghead) than turtles and other fishes due to their physostomus (pneumatic duct connects gas bladder and gut to allow gas to be taken in and emitted vs. psysoclistous fishes that lose the connection in adults) swim bladder; are not known to bury themselves and "hibernate" in the soft bottom mud of ship channels (but they are known to remain for long periods in low areas) as are some turtles (e.g., in Kings Bay and Brunswick Harbor, Georgia); and are mobile and are not likely to be entrained, even by a rapidly (approximately 3-5 knots) approaching hopper dredge deflector draghead. Although no take of a Gulf sturgeon by hopper dredge (or any other type of dredge) operating in the Gulf of Mexico has ever been reported to NOAA Fisheries, Atlantic sturgeon have been documented as taken by hopper dredges. Shortnose sturgeon have also been lethally taken by hydraulic pipeline dredging in the Delaware River since 1996. A shortnose sturgeon was taken by a mechanical clam shell bucket dredge in the Northeast (J. Crocker, June 10, 2003, pers. comm. to S. Bolden) and recently five shortnose were taken by a hopper dredge in the Kennebec River, Maine during emergency dredging operations there (J. Crocker, October 15, 2003, pers. comm. to S. Bolden). NOAA Fisheries believes that Gulf sturgeon can be lethally taken by hopper dredges, and it is most likely to occur in the northern or eastern Gulf of Mexico during dredging of barrier island passes or nearby sand sources during winter months.

Gulf Sturgeon Takes Associated with Sand Mining
NOAA Fisheries knows of no Gulf sturgeon takes associated with mining of sand from nearshore or offshore mining sites by hopper dredge or any other type of dredge. Gulf sturgeon presence would be unlikely at these sites, unless mining sites were near barrier island pass foraging sites or along migratory pathways (which are primarily inshore).

C. Dredging Effects on Gulf Sturgeon Critical Habitat

This Opinion identifies specific projects that will impact Gulf sturgeon critical habitat units #8 and #11 and four (of the seven) PCEs (food availability, water quality, sediment quality and migratory pathways) within both of those units (Table 3).

Table 3. Summary of COE projects within this Opinion that occur within designated Gulf sturgeon critical habitat or may impact Gulf sturgeon.

District/Project	Genetic stock*	Critical Habitat Unit	Riverine Pop Impacted
GALVESTON			
None			
NEW ORLEANS			
Lower Mississippi R.	Lake Pontchartrain Pearl River	None	Mississippi
Mississippi River - New Orleans Harbor	Lake Pontchartrain Pearl River	None	Mississippi
Mississippi River - Gulf Outlet	Lake Pontchartrain Pearl River	None	Mississippi
Mississippi River - Southwest Pass	Lake Pontchartrain Pearl River	None	Mississippi
MOBILE			
Gulfport Harbor	Pascagoula River	#8	Pascagoula/Pearl
Pascagoula Harbor	Pascagoula River	#8	Pascagoula/Pearl
Mobile Harbor	Pascagoula River	None	Mobile
Pensacola Harbor	Escambia/Yellow Rivers	#11	Yellow, Choctawhatchee and Apalachicola

JACKSONVILLE			
Pensacola Beach	Escambia/Yellow Rivers	#11	Yellow, Choctawhatchee and Apalachicola
NAS Pensacola Channel	Escambia/Yellow Rivers	#11	Yellow, Choctawhatchee and Apalachicola
Tampa Harbor	?	None	?
Charlotte Harbor	?	None	?

*Five regional or river-specific stocks (from west to east) have been identified: (1) Lake Pontchartrain and Pearl River, (2) Pascagoula River, (3) Escambia and Yellow Rivers, (4) Choctawhatchee River, and (5) Apalachicola, Ochlockonee, and Suwannee Rivers (Stabile et al. 1996). Because of small sample size, genetic stocks could not be determined for fish in the southeast (i.e., Tampa Area) as indicated by the "?."

Maintenance dredging is a repetitive activity in coastal Gulf of Mexico; some channels are dredged continuously to keep them navigable, others require dredging cycles of 2-10 years. Maintenance dredging removes sediments from navigation channel beds that have been transported there naturally (e.g., longshore transport). Materials removed during maintenance dredging are usually variable in quantity and consist of soft, uncompacted soil. For the purpose of this Opinion, NOAA Fisheries assumes that the sediments removed from the channel beds during maintenance dredging are similar to those that will remain in the channel beds after dredging (e.g., removal of sand and sand remaining) and therefore no alteration in habitat composition is occurring. Therefore, NOAA Fisheries assumes that channel beds provide similar habitat pre- and post-dredging.

NOAA Fisheries considered and analyzed the following factors to determine direct and indirect effects of dredging to current depth, width and length (no improvements regardless of prior authorization) within critical habitat on the four PCEs in units #8 and #11:

1. Food availability
2. Water quality
3. Sediment quality, and
4. Migratory pathways

1. Food Availability

Numerous reports have been published in the scientific literature describing the in situ effects of dredging and dredged material placement on birds, lobsters, fish, aquatic plants, benthic communities, turbidity, primary productivity, bioavailability of sediment trace metals, etc. (Lewis et al. 2001). Environmental impacts observed in these studies included reduction in number of benthic species (both species diversity and species abundance), increased turbidity, reduction of primary productivity and mobilization, and increased bioavailability of sediment trace metals.

Of particular concern is the potential impacts of dredging on Gulf sturgeon prey availability. Ontogenetic changes in Gulf sturgeon diet and foraging area have been documented. Young-of-year forage in freshwater on aquatic invertebrates and detritus (Mason and Clugston 1993, Sulak and Clugston 1999); juveniles forage throughout the river on aquatic insects (e.g., mayflies and caddisflies), worms (oligochaete), and bivalves (Huff 1975, Mason and Clugston 1993); adults forage sparingly in freshwater and depend almost entirely on estuarine and marine prey for their growth (Gu et al. 2001). Both adult and subadult Gulf sturgeon are known to lose up to 30% of their total body weight while in fresh water, and subsequently compensate the loss during winter feeding in marine areas (Carr 1983, Wooley and Crateau 1985, Clugston et al 1995, Morrow et al. 1998, Heise et al. 1999, Sulak and Clugston 1999, Ross et al. 2000). Therefore, once Gulf sturgeon leave the river having spent at least six months in the river fasting, it is presumed that they immediately begin feeding. Upon exiting the rivers, Gulf sturgeon initially concentrate around the mouths of their natal rivers in lakes and bays; they then disperse into nearshore areas (including Passes) and continue to forage. Therefore, the nearshore foraging and migratory areas are very important for the Gulf sturgeon as they offer not only the first foraging opportunity for the Gulf sturgeon exiting the rivers, but also migratory pathways to winter habitat and, more rarely, to other rivers.

Few data have been collected on the food habits of Gulf sturgeon; their threatened status limits sampling efforts and gastric lavaging has only recently become successful (anal lavaging is being investigated). Gulf sturgeon have been described as opportunistic and indiscriminate benthivores; their guts generally contain benthic marine invertebrates including amphiopods, lancelets, polychaetes, gastropods, shrimp, isopods, molluscs, and crustaceans (Huff 1975, Mason and Clugston 1993, Carr et al. 1996, Fox et al. 2000, Fox et al. 2002). During the early fall and winter, immediately following downstream migration, Gulf sturgeon are most often located in nearshore (depth less than 20 feet) sandy areas that support burrowing macroinvertebrates, presumably foraging (Craft et al. 2001, Ross et al. 2001a, Fox et al. 2002, Parauka et al. in press).

Short-term (one month) impacts on benthic macroinvertebrates following dredging were investigated by comparing community structure in a Florida bayou pre- and post-dredging: a significant reduction in both density (of species and individuals) and diversity was recorded (Lewis et al. 2001); of particular interest was the predominance of polychaetes (relative abundance of 68% pre- to 23% post-disposal) prior to dredging being replaced by harpacticoid copepods (from 6% to 69%) (Lewis et al. 2001). Comparison of mollusks from dredged and non-dredged areas in Boga Ciega Bay, Florida indicated a much smaller number and diversity of species in the dredged canals that in non-dredged areas (Sykes and Hall 1970).

2. Water Quality

Water quality impacts as a result of dredging are expected to be temporary, with suspended particles settling out within a short time frame. These sediment disturbance impacts will be minimal in nature and will not have a measurable effect on water quality (or on sea turtles or Gulf sturgeon directly). Additionally, past sampling of water column and elutriate chemistry in various locations within the project area demonstrated that dredging is not likely to significantly impact water quality. Potential changes in salinity and tidal amplitude are expected to be minimal. NOAA Fisheries does not expect measurable impacts to Gulf sturgeon critical habitat as a result of water quality impacts related to this project.

3. Sediment Quality

Potential impacts to sediment quality as a direct result of dredging channel beds were considered in this Opinion. The composition of dredged material removed from the channel beds is expected to be the same as that remaining. Because this Opinion is only authorizing dredging to maintain channels at depths existing at the time of this consultation, regardless of depth previously authorized, the sediments removed from the channel beds should be similar to those in the surrounding area given that shoaling is a result of transport from nearby areas (consisting of soft materials). Therefore, it is unlikely that the materials removed from the channels considered in this Opinion are different in composition from those that would remain in the channel beds following dredging. The COE shall contact NOAA Fisheries if they believe or have evidence indicating, for any of the projects considered within this Opinion, that dredged material is not compatible to that remaining in the channel beds in terms of grain size, color and composition. Therefore, NOAA Fisheries does not expect measurable impacts to Gulf sturgeon critical habitat as a result of sediment quality impacts related to these projects.

4. Migratory Pathways
Effects on migratory pathways as a PCE for units #8 and #11 were considered in this Opinion. These two units are known to support migratory pathways for Gulf sturgeon from at least three genetic subpopulations (Lake Pontchartain/Pearl River, Pascagoula River and Escambia/Yellow Rivers) and at least seven riverine subpopulations (Mississippi, Pascagoula, Pearl, Mobile, Choctawhatchee, Yellow, and Apalachicola Rivers) as groups of individuals from these subpopulations have been located by telemetry on numerous occasions within units #8 and #11 (Rogillio 1993, Ross et al. 2000, Ross et al. 2001b, Parauka et al. in press, F. Parauka USFWS pers. comm. 2002, Rogillio et al. in prep). Gulf sturgeon move through these two units for two main reasons: migration between winter and summer habitats (foraging along the way), and, more rarely, for inter-riverine movements. Because the hopper dredging associated with the project located in Gulf sturgeon critical habitat (Table 3) will be localized and not span the length/width of a unit, NOAA Fisheries concluded that the dredging events will not preclude passage through the migratory pathways by the Gulf sturgeon and therefore adequate area for migration will be available.

D. Effects of Relocation Trawling (Capture, Tag, and Release) in Association with Hopper Dredging

Relocation trawling has been successful at temporarily displacing Kemp's ridley, loggerhead, leatherback, and green sea turtles from channels and nearshore mining areas in the Atlantic and Gulf of Mexico (e.g., Thimble Shoals Channel, Virginia Beach, Virginia; Morehead City, Wilmington, and Bogue Banks, North Carolina; Charleston, South Carolina; Kings Bay, Georgia; Canaveral Entrance Channel, Tampa Bay, Charlotte Harbor, and St. Petersburg Harbor, Florida; MR-GO, Louisiana; Freeport Harbor, Aransas Pass, and Sabine-Neches Waterway, Texas) during periods when hopper dredging was imminent or ongoing. Some turtles captured during relocation trawling operations return to the dredge site and are subsequently recaptured. Sea turtle relocation studies by Standora et al. (1993) at Canaveral Channel relocated 34 turtles to six release sites of varying distances north and south of the channel. Ten turtles returned from southern release sites, and seven from northern sites, suggesting that there was no significant difference between directions. Return times observed suggested that there was a direct correlation between relocation distance and likelihood of return or length of return time to the channel when sea turtles were relocated to the south. No correlation was observed between the northern release sites and the time or likelihood of return. The study found that relocation of turtles to the site 70 km (43 miles) south of the channel would result in a return time of over 30 days.

REMSA, a private company contracted to conduct relocation trawling captured, tagged, and relocated 69 turtles in a 7-day period at Canaveral Channel in October 2002, with no recaptures; turtles were relocated a minimum of 3-4 miles away (Trish Bargo, REMSA, June 2, 2003 pers. comm. to Eric Hawk). Twenty-four hour per day relocation trawling conducted by REMSA at Aransas Pass Entrance Channel (Corpus Christi Ship Channel) from April 15, 2003, to July 7, 2003, relocated 71 turtles from ca 1.5-5 miles from the dredge site, with three recaptures (Trish Bargo, July 24, 2003 pers. comm. to Eric Hawk). One turtle released on June 14, 2003, around 1.5 miles from the dredge site, was recaptured four days later; another turtle released captured June 9, 2003, released about three miles from the dredge site was recaptured nine days later. Subsequent releases occurred five miles away. Of these 68 subsequent capture/releases, one turtle released on June 22, 2003 was recaptured 13 days later (REMSA Final Report, Sea Turtle Relocation Trawling, Aransas Pass, Texas, April-July 2003).

Prior to 1997, most relocation trawling in association with hopper dredging was performed by the Corps of Engineers under a NOAA Fisheries ESA section 10 incidental take/research permit. Since then, however, relocation trawling has primarily been conducted by private companies. In the last three years, Coastwise Consulting, Inc., has conducted over 132 days of relocation trawling at Morehead City, North Carolina; Charleston, South Carolina; and Kings Bay, Georgia (e-mail, C. Slay to E. Hawk, October 25, 2002). During the course of this work, at least 43 loggerheads, ten Kemp's ridleys, and one green turtle were successfully captured, tagged, and released. No dead or injured turtles were encountered and no captured turtles were recaptured during this work. Since around 1998, Coastwise Consulting has captured, tagged, and released approximately 80-90 turtles, with no evidence of injury or mortality (Pers. comm., C. Slay to E. Hawk, December 6, 2002). On the Atlantic coast, REMSA has also successfully tagged and relocated over 140 turtles in the last several years, most notably, 69 turtles (55 loggerheads and 14 greens) in a 7-day period at Canaveral Channel in October 2002, with no significant injuries. Other sea turtle relocation contractors (R. Metzger in 2001; C. Oravetz in 2002) have also successfully and non-injuriously trawl-captured and released sea turtles out of the path of oncoming hopper dredges. More recently in the Gulf of Mexico, REMSA captured, tagged, and relocated 71 turtles at Aransas Pass with no apparent long-term ill effects to the turtles. Three injured turtles captured were subsequently transported to University of Texas Marine Science Institute rehabilitation facilities for treatment (two had old, non-trawl related injuries or wounds; the third turtle may have sustained an injury to its flipper, apparently from the door chain of the trawl, during capture). Three of the 71 captures were recaptures–released around 1.5, three, and five miles, respectively, from the dredge site–and exhibited no evidence that their capture, tag, release, and subsequent recapture, was in any way detrimental.

The effects of this harassment of the turtles during capture and handling can result in raised levels of stressor hormones, and can cause some discomfort during tagging procedures. Based on past observations obtained during similar research-trawling for turtles, these effects are expected to dissipate within a day (Stabenau and Vietti 1991). Since turtle recaptures are rare, and recaptures that do occur typically happen several days to weeks after initial capture, cumulative adverse effects of recapture are not expected.

Rarely, even properly conducted relocation trawling can result in accidental sea turtle deaths. Henwood (pers. comm. to E. Hawk, December 6, 2002) noted that trawl-captured loggerhead sea turtles died on several occasions during handling on deck during winter trawling in Canaveral Channel in the early 1980s, after short (approximately 30-minute) tow times. However, Henwood also noted that a significant number of the loggerheads captured at Canaveral during winter months appeared to be physically stressed and in "bad shape" compared to loggerheads captured in the summer months from the same site, which appeared much healthier and robust. Stressed turtles or unhealthy turtles or turtles exposed to repeated forced submergences are more likely to be injured or killed during relocation trawling than healthy turtles.

In November 2002, during relocation trawling conducted in York Spit, Virginia, a Kemp's ridley sea turtle was likely struck by one of the heavy trawl doors or it may have been struck and killed by another vessel shortly before trawl net capture. The hopper dredge was not working in the area at the time (pers. comms. and e-mails, P. Bargo to E. Hawk, December 6 and 9, 2002).

NOAA Fisheries typically limits tow times for relocation trawling to 42 minutes or less measured from the time the trawl doors enter the water when setting the net to the time the trawl doors exit the water during haulback ("doors in - doors out"). The National Research Council report "Decline of the Sea Turtles: Causes and Prevention" (NRC 1990) suggested that limiting tow durations to 40 minutes in summer and 60 minutes in winter would yield sea turtle survival rates that approximate those required for the approval of new TED designs, i.e., 97%. The NRC report also concluded that mortality of turtles caught in shrimp trawls increases markedly for tow times greater than 60 minutes. Current NOAA Fisheries' TED regulations allow, under very specific circumstances, for shrimpers with no mechanical-advantage trawl retrieval devices on board, to be exempt from Federal TED requirements if they limit tow times to 55 minutes during April through October and 75 minutes from November through March. The presumption is that these tow time limits will result in turtle survivability comparable to having TEDs installed.

The Gulf and South Atlantic Fisheries Development Foundation's August 31, 1998, "Alternatives to TEDs: Final Report," presents data on 641 South Atlantic shallow tows (only one tow was in water over 15 fathoms [27.4 m]), all conducted under restricted tow times (55 minutes during April through October and 75 minutes from November through March), and 584 Gulf of Mexico nearshore tows conducted under the same tow time restrictions. Offshore effort in the Gulf of Mexico consisted of 581 non-time restricted tows which averaged 7.8 hours per tow. All totaled, 323 turtle observations were documented: 293 in the nearshore South Atlantic efforts, and 30 in the Gulf efforts (24 nearshore and six offshore). Of the 293 South Atlantic turtles (219 loggerhead, 68 Kemp' ridley, five green, and one leatherback), only 274 were used in the analyses (201 loggerhead, 67 Kemp's ridley, five green, and one leatherback) because 12 escaped from the nets after being seen and seven were caught in try nets. Of the 274 South Atlantic turtles captured using restricted tow times, only five loggerheads and one Kemp's ridley died because of the interaction. For the Gulf efforts, 26 turtles (eight loggerhead, 16 Kemp's ridley, two green) were captured, resulting in three mortalities (one loggerhead inshore, one loggerhead and one green offshore). Excluding all six offshore tows and both offshore mortalities (because of the prolonged, non-restricted tow times), we are left with 1,225 time-restricted tows (584 + 641) resulting in 298 trawl-captured turtles (274 + 24) resulting in seven mortalities, i.e., 2.3% of the interactions resulted in death.

In summary, NOAA Fisheries believes that properly conducted and supervised relocation trawling (i.e., observing trawl speed and tow-time limits, and taking adequate precautions to release captured animals) and tagging is unlikely to result in adverse effects to sea turtles. NOAA Fisheries estimates that, overall, sea turtle trawling and relocation efforts will result in considerably less than 0.5% mortality of captured turtles, primarily due to their being previously stressed or diseased or if struck by trawl doors or accidents on deck. On the other hand, hopper dredge entrainments invariably result in injury, and are almost always fatal. In the present Opinion, NOAA Fisheries requires relocation trawling and tagging as methods of reducing sea turtle entrainment in hopper dredges and to document the effects of relocation trawling, according to criteria defined in the ITS.

<u>Effects and desirability of tagging relocated animals:</u>
Tagging prior to release will help us learn more about the habits and identity of these trawl-captured animals after they are released; and if they are recaptured will enable improvements in relocation trawling design to further reduce the effect of the take. External and internal flipper tagging (e.g., with Inconel and PIT tags) are not considered dangerous procedures by the sea turtle research community; are routinely done by thousands of volunteers in the United States and abroad; and can be safely accomplished with minimal training. NOAA Fisheries knows of no instance where flipper tagging has resulted in mortality or serious injury to a trawl-captured sea turtle. Such an occurrence would be extremely unlikely because the technique of applying a flipper tag is minimally traumatic and relatively non-invasive; in addition, these tags are attached using sterile techniques. Important growth, life history, and migratory behavior data may be obtained from turtles captured and subsequently relocated. Therefore, these turtles should not be released without tagging (and scanning for pre-existing tags).

Collection of tissue samples: Tissue sampling is performed to determine the genetic origins of captured sea turtles, and learn more about their nesting beach/population origins. This is important information because some populations, e.g., the northern subpopulation of loggerheads nesting in the Southeast Region, may be declining. For all tissue sample collections, a sterile 4- to 6-mm punch sampler is used. Researchers who examined turtles caught two to three weeks after sample collection noted that the sample collection site was almost completely healed (Witzell, pers. comm.). NOAA Fisheries does not expect that the collection of a tissue sample from each captured turtle will cause any additional stress or discomfort to the turtle beyond that experienced during capture, collection of measurements, and tagging. Tissue sampling procedures are specified in the terms and conditions of this Opinion.

E. Effects of Dredged Material Disposal on Sea Turtles, Gulf Sturgeon, and Critical Habitat

NOAA Fisheries has reviewed the maintenance dredging projects that occur in the Gulf of Mexico on a recurring basis (see Proposed Action section for by-District project descriptions) and the disposal sites and methods which the COE uses to dispose of dredged material. Typically, dredged materials from channel maintenance dredging activities are disposed of down current of the navigation channels being maintained (by agitation dredging and sidecasting), or in designated disposal areas which are adjacent to and run approximately parallel to the navigation channels, or in nearby designated offshore disposal areas (to minimize transit time of the hopper dredge to and from the dredging site). Alternatively, they are used beneficially for barrier island restoration and creation of island, wetland, marsh, and shallow-water habitats, or to renourish eroded mainland beaches. With the exception of disposal of dredged materials within designated Gulf sturgeon critical habitat (which is not considered in this Opinion and must be consulted on individually by each COE District for projects under their respective permitting authority), NOAA Fisheries believes that disposal activities currently being conducted, and proposed to be continued, by the Galveston District, New Orleans District, Mobile District, and Jacksonville District are unlikely to adversely affect sea turtles or Gulf sturgeon. These species are highly mobile and should be able to easily 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. This Opinion does not allow disposal actions within foraging habitat areas designated as Gulf sturgeon critical habitat. NOAA Fisheries also believes that foraging habitat for sea turtles is not likely a limiting factor in the Gulf of Mexico COE Districts and thus the temporary removal of relatively small areas (compared to remaining foraging habitat) of potential foraging habitat by burial with dredged material sediment will not measurably adversely affect sea turtles. Furthermore, large portions of areas routinely dredged by the New Orleans District in the MR-SWP and associated disposal sites are not suitable foraging habitat for sea turtles because of high freshwater flows. As well, typical nearshore areas of the Gulf of Mexico that are routinely renourished (e.g., west Florida beaches of Pinellas, Sarasota, Lee Counties), or might be renourished, or are being considered for renourishment (e.g., Orange Beach/Gulf Shores, Alabama) are not considered by NOAA Fisheries to be of particularly significant or essential foraging value to sea turtles. Turtles will typically forage further offshore where non-ephemeral limestone ledges supporting algal/sponge growth are located. These ledges are not routinely covered by shifting sands, as they are prone to in the high wave-energy nearshore environment. Foraging habitat for Gulf sturgeon, recognized with the designation of critical habitat, will not be adversely affected by this action. Furthermore, beach renourishment projects typically affect yearly only a minute portion of the many hundreds of miles of Gulf of Mexico nearshore beach environment available for foraging sea turtles.

COE District disposal activities (principally, Jacksonville District COE) which involve renourishing beaches where sea turtles nest are consulted on by the U.S. Fish and Wildlife Service because sea turtles on land fall under the purview of that agency. NOAA Fisheries believes that deposition of dredged materials on the beach or in the littoral nearshore environment for beach renourishment and creation of island, wetland, marsh, and shallow-water habitats in the Gulf of Mexico by any of the COE Districts during beach restoration or habitat restoration projects (excepting disposal in designated Gulf sturgeon critical habitat) described in the Proposed Action section of this Opinion, and similar actions, will not adversely affect sea turtles or Gulf sturgeon and may ultimately be of benefit to them if restoration efforts are successful. Nearshore habitats for foraging sea turtles and Gulf sturgeon are present in sufficient quantities such that removal of relatively small portions of potential foraging habitat will not cause measurable adverse effects on sea turtles or Gulf sturgeon.

Disposal Effects on Benthos

Sediment composition is a cardinal factor in controlling the settlement and viability of many marine invertebrates (Thorson 1956). In addition, benthic recovery is dependent on time of year. Placement of materials similar to ambient sediments (e.g., sand on sand or mud on mud) has been shown to produce less severe impacts in contrast to placement of dissimilar sediments, which generally results in more severe, long-term impact (Maurer et al. 1978, 1986). Deposition of relatively thin layers of dredged material (<10 cm; 4 in) can minimize impacts by allowing many populations of small, shallow-burrowing infauna with characteristically high reproductive rates and wide dispersal capabilities to recover quickly. Deposits greater than 20-30 cm (8-12 in) generally eliminate all but the largest and most vigorous burrowers (Maurer et al. 1978).

Observed rates of benthic community recovery after dredged material placement range from a few months to several years. The relatively species-poor benthic assemblages associated with low salinity estuarine sediments can recover in periods of time ranging from a few months to approximately one year (Leathem et al. 1973, McCauley et al. 1976, 1977, Van Dolah et al. 1979, 1984, Clarke and Miller-Way 1992), while the more diverse communities of high salinity estuarine sediments may require a year or longer (e.g., Jones 1986, Ray and Clarke 1999). Recovery rates for sandy inshore marine sites, should be similar to those reported for high salinity estuarine sites (Oliver et al. 1977, Richardson et al. 1977, Haskin et al. 1978, Van Dolah et al. 1984) if the overburden is comprised of similar sediments.

Most of what is known about the species specific recovery/recolonization of benthic communities following dredge material placement in the Gulf of Mexico is the result of work by Rakocinski et al. (1991, 1993, 1996); others (e.g., Dixon and Pilkey 1991, Nelson 1993) have focused on benthic recovery following beach restoration. Generally recovery/recolonization is dependent upon sediment-type, time, depth of overburden, depth, proximity to beach. One long-term (two year) study monitored recovery and concluded that while recolonization occurred, the macrobenthic community structure was different and wide fluctuations between stations was present two years post-event (Rakocinski et al. 1996).

NOAA Fisheries concludes that the effects of dredged material disposal on benthic communities is unlikely to adversely affect sea turtles or Gulf sturgeon.

Disposal Effects on Gulf Sturgeon Critical Habitat

No disposal within Gulf sturgeon critical habitat is authorized in this Opinion (see section entitled "Description of the Action Area and Proposed Action"). Therefore, NOAA Fisheries concludes that there are no disposal effects on Gulf sturgeon critical habitat.

F. Anticipated Incidental Take Levels Predicted for Each COE District:

While it is impossible to ascertain the exact number of future take of sea turtles and Gulf sturgeon, NOAA Fisheries bases the estimated anticipated take levels on the following data:

1. Previous sea turtle takes associated with hopper dredging during Gulf of Mexico maintenance dredging and sand mining operations by the COE's New Orleans, Galveston, and Jacksonville Districts (Mobile District has previously not had observers on hopper dredges so the historic level of incidental take, if any, is unknown);

2. The level of take anticipated in previous Opinions;

3. The distribution and abundance of sea turtles and Gulf sturgeon in the Gulf of Mexico;

4. COE adherence to dredging windows;

5. The magnitude of, and operational measures (including relocation trawling) employed by, individual dredging projects;

6. Documented sturgeon take by dredges on the Atlantic coast;

7. The number and description of the hopper dredging projects provided by each District; and

8. The proportion of known reproducing populations of Gulf sturgeon (total = 7) geographically located within each District.

Fresh Takes vs. Decomposed Takes

The incidental level of both sea turtle and Gulf sturgeon take is anticipated to consist of "fresh dead" animals. However, NOAA Fisheries realizes that dredging may produce an additional unquantifiable number of "previously dead" sea turtles or turtle parts. While decomposed animals taken in Federal operations are considered to be takes (the possession of a listed species is considered a take), NOAA Fisheries recognizes that decomposed sea turtles whose deaths were not necessarily related to the present activity may be entrained by the dredge. Theoretically, if dredging operations are conducted properly, no takes of sea turtles should occur since the turtle draghead defector should push the turtles to the side and the suction pumps should be turned off whenever the dredge draghead is away from the substrate. However, due to certain environmental and other conditions (e.g., rocky bottom, uneven substrate, sea swells, draghead operator error, clogged dragheads, etc.), the dredge dragheads may periodically lift off the bottom and draw in any other previously dead sea turtles or turtle parts it may encounter. Reviews of observer records reveal that entrainment of old turtle bones during hopper dredging operations occasionally occurs. Therefore, takes of decomposed listed species shall be evaluated on a case-by-case basis by NOAA Fisheries; these takes, depending upon the circumstances, may or may not be ascribed to the ongoing dredging operation and may or may not be counted towards the anticipated take level.

NOAA Fisheries relies heavily on the unbiased reports of the onboard endangered species observer and other sources of information (such as commercial fisheries operating in the area) when determining take of a listed species. Provided that NOAA Fisheries concurs with the COE's determination regarding the stage of decomposition, condition of the specimen, and ultimately the likely cause of mortality, the take may or may not be attributed to the incidental take level for a project. Similarly, sometimes parts of one dismembered turtle are taken in separate loads, sometimes several days apart; if the parts are a good "match" and appear to be from the same animal, NOAA Fisheries will likely determine that only a single turtle was taken. Also, turtles or sturgeon may strand near dredging operations, bearing marks or damage which could be construed as evidence of hopper dredge entrainment. NOAA Fisheries shall study these situations carefully in consultation with the affected COE Districts and Sea Turtle Stranding and Salvage Network (STSSN) personnel before reaching a determination on whether or not to count these as takes.

Take levels for the Galveston and New Orleans Districts are expected to remain identical to those established in the September 22, 1995, RBO, except that Gulf sturgeon takes will now be authorized for the New Orleans District. Since the RBO was issued, neither District has met or exceeded the established annual incidental take level (although the New Orleans District in July 2001 reinitiated consultation with

NOAA Fisheries when high turtle take levels in the MR-GO resulted in the District reaching 75% of its authorized take level of loggerhead sea turtles). NOAA Fisheries believes that the previously established anticipated take levels are still valid; however, one Gulf sturgeon will be added to the New Orleans District take limit where previously there was none, because NOAA Fisheries believes that there is a significant possibility that a Gulf sturgeon will be taken by a New Orleans District hopper dredge in the future. No Gulf sturgeon takes will be added to the Galveston District's take limit because Gulf sturgeon are not known to occur in the Galveston District.

Sea turtles and Gulf sturgeon may occur within the Mobile District's navigation channels and sand mining areas. Hopper dredge use by the Mobile District has occurred regularly in the past, but without observers to document potential sea turtle or Gulf sturgeon entrainment. Currently, a NOAA Fisheries' biological opinion does not exist to authorize potential takes during Mobile District hopper dredging activities. Although no take of listed turtles or sturgeon in the Mobile District have been reported to NOAA Fisheries, this is believed to be a reflection of the lack of observers present to monitor incoming dredged material for turtle and sturgeon parts. The present Opinion anticipates a limited amount of take for sea turtles and Gulf sturgeon by the Mobile District.

The Jacksonville District may incidentally take sea turtles and Gulf sturgeon in their hopper dredging operations west and north of Key West, Florida (takes in Key West channels are covered by the existing September 25, 1997, RBO to the COE's SAD); therefore, a take limit must be set for the Jacksonville District's Florida West Coast hopper dredging projects (Key West [excluding Key West navigation channels] to Aucilla River Basin [including the Aucilla River], Florida). The biennial incidental take level established for sea turtles and Gulf sturgeon in the October 1999 Charlotte Harbor Opinion will be subsumed into the Jacksonville District's Florida West Coast take level established in the present Opinion.

Anticipated Gulf-wide Take of Sea Turtles and Gulf Sturgeon by Hopper Dredges:

For the entire Gulf of Mexico from the U.S.-Mexico border to Key West, the annual documented COE incidental take per fiscal year, by injury or mortality, is expected to consist of twenty (20) Kemp's ridley turtles, fourteen (14) green turtles, four (4) hawksbill turtles, forty (40) loggerhead turtles, and four (4) Gulf sturgeon. This take level represents a total take per fiscal year for all channel dredging and sand mining by hopper dredges in the Gulf of Mexico by the COE's Galveston, New Orleans, Mobile, and Jacksonville Districts collectively.

Galveston District
For the Galveston District, the annual documented incidental take, by injury or mortality, is expected to consist of seven (7) Kemp's ridleys, five (5) green turtles, one (1) hawksbill, and fifteen (15) loggerhead turtles per fiscal year for all channel dredging and sand mining by hopper dredge in the Galveston District. This level of take represents the same level of take authorized by the previous Opinion.

New Orleans District
For the New Orleans District, the documented annual incidental take, by injury or mortality, is expected to consist of seven (7) Kemp's ridleys, three (3) green turtles, one (1) hawksbill, and fifteen (15) loggerhead turtles, and one (1) Gulf sturgeon per fiscal year for all channel dredging and sand mining by hopper dredge in the New Orleans District. As in the previous Opinion, a greater number of green turtles is included in the incidental take level predicted for the Galveston District due to the greater abundance of green turtles in south Texas waters.

Mobile District (Florida Panhandle west of Aucilla River Basin to, but not including, the Mississippi River)
For the Mobile District, the documented annual incidental take, by injury or mortality, is expected to consist of three (3) Kemp's ridley, three (3) green turtles, one (1) hawksbill, five (5) loggerhead turtles, and two (2) Gulf sturgeon per fiscal year for all channel dredging and sand mining by hopper dredge in the Mobile District. A greater number of Gulf sturgeon is included in the incidental take level predicted for the Mobile District than the New Orleans District due to the larger proportion of reproducing populations of of Gulf sturgeon in the former District.

Jacksonville District (Florida West Coast: Aucilla River Basin to, but not including, Key West)
For the Jacksonville District, the documented annual incidental take, by injury or mortality, is expected to consist of three (3) Kemp's ridleys, three (3) green turtles, one (1) hawksbill, five (5) loggerhead turtles, and one (1) Gulf sturgeon per fiscal year for all channel dredging and sand mining by hopper dredge in the Jacksonville District west of Key West (hopper dredging of Key West navigation channels is covered under the existing regional hopper dredging RBO to the COE's SAD).

Anticipated Takes of Sea Turtles and Gulf Sturgeon through Relocation Trawling:

Though not included by the COE as an integral part of the proposed action, this Opinion will require the use of relocation trawling as a reasonable and prudent measure (RPM) to reduce the effect of take of turtles by hopper dredges. Even though relocation trawling involves directed take of turtles, it constitutes a legitimate RPM because it reduces the level of almost certain lethal and injurious take of sea turtles by hopper dredges, and allows the turtles captured non-injuriously by trawl to be relocated out of the path of the dredges. The Consultation Handbook (for Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act, U.S. Fish and Wildlife Service and National Marine Fisheries Service, March 1998) expressly authorizes such directed take as an RPM at page 4-54. Therefore, NOAA Fisheries will in this section evaluate the expected level of turtle take through required relocation trawling, so that these levels can be included in the evaluation of whether the proposed action will jeopardize the continued existence of the species.

Between October 1, 2002, and the present, approximately 80 sea turtles have been relocated in association with Gulf of Mexico hopper dredging projects, including projects at Aransas Pass, Brownsville Entrance Channel, and the MR-GO, by contract trawlers. Although 2002 was the first year the Galveston District conducted relocation trawling in association with some of its hopper dredging projects, henceforth the District will require mandatory 24-hr/day relocation trawling in association with all dredging projects within the District (Rob. Hauch, pers. comm. to E. Hawk, July 22, 2003).

NOAA Fisheries estimates that yearly relocation trawling in all of the navigation channels and sand mining areas of the Gulf of Mexico will take no more than 300 loggerhead, green, hawksbill, and Kemp's ridley sea turtles, and eight (8) Gulf sturgeon. This number is based on past recent history of relocation trawler takes in the Gulf of Mexico, information on Gulf sturgeon takes by shrimp trawlers at Gulf of Mexico barrier island passes (H. Rogillio, pers. comm. to Eric Hawk), the possibility that the events at Aransas Pass (where 70+ turtles were captured in 10 weeks during 2003) will repeat in other places in the Gulf of Mexico (perhaps simultaneously), increased presence of sea turtles in coastal waters as turtle populations recover and new TED regulations take effect leading to increased trawl capture rates, increased relocation trawling efforts in the Gulf of Mexico spurred in part by this summer's trawling success at Aransas Pass and MR-GO, the Galveston District's stated intent to conduct relocation trawling during on all their future District dredging projects (Rob Hauch, pers. comm. to Eric Hawk), probable increases in Gulf of Mexico summertime dredging when water temperatures are warmer and sea turtles are more abundant, and predicted relocation trawling captures by COE Districts in the Gulf of Mexico that have never before done so (i.e., Mobile District). As stated in the Reasonable and Prudent Measures, and Terms and Conditions of this ITS, relocation trawling is required under specific circumstances. This relocation trawling may result in sea turtle and Gulf sturgeon takes, but these takes are not expected to be injurious or lethal due to the short duration of the tow times (15 to 30 minutes per tow; not more than 42 minutes, as per Term and Condition No. 15) and required safe-handling procedures.

Estimated turtle take is derived as follows: In FY03, Shoreline Consulting captured 1-2 turtles at Aransas Pass, REMSA captured 71 turtles at Aransas Pass, relocation trawling at Brownsville Entrance Channel captured at least five more, and relocation trawling at the MR-GO captured seven in 2 ½ weeks, for a FY03 total of 85 turtles. However, if Galveston District dredged two large projects simultaneously in the summer, they could conceivably more than double the numbers taken this year. The three remaining COE Districts in the Gulf of Mexico would also be likely to be simultaneously conducting relocation trawling on some of their projects. Also, some major navigation projects have not been dredged in years and are due (e.g., Tampa Bay), as are minor projects known to take sea turtles (e.g., St. Petersburg Harbor). NOAA Fisheries arrived at the estimate of 300 potential sea turtle trawl captures yearly by Gulf of Mexico relocation trawlers by doubling the amount taken this year at Aransas Pass on the assumption that two large projects in the summer would take twice as many as one (73 x 2 = 146), then doubling it again to account for all the other uncertainties including increasing turtle populations, increased effectiveness of the larger TED escape openings, increased acceptance and use of relocation trawling, increased summer time trawling, increasing number of beach renourishment projects in the Gulf of Mexico.(146 x 2= 294), then rounding to 300 to allow an extra margin for error.

Sturgeon takes are estimates based on reports of Gulf sturgeon take by trawlers operating near Gulf of Mexico barrier island passes (H. Rogillio, pers. comm. to E. Hawk, 2002) and reports of gillnet interactions with Gulf sturgeon near passes where Gulf sturgeon are known to congregate in winter.

G. Summary of Effects of the Proposed Action on Sea Turtles, Gulf Sturgeon, and Gulf Sturgeon Critical Habitat

Stranding information indicates that sea turtle aggregations are found in the vicinity of Gulf of Mexico navigation channels and that sea turtles are present in nearshore Gulf coastal waters year-round. The previous NOAA Fisheries Opinion governing hopper dredging in the northern and western Gulf of Mexico (NMFS 1995) noted that shallow, warm, nearshore waters in the northern Gulf of Mexico provide prime Kemp's ridley habitat until cooling waters force turtles offshore or south along the Florida and southwest Texas coast. Generally, Kemp's ridleys were observed in water depths of less than 18 m and surface water temperatures greater than 12°C. Based on the year-round presence of sea turtles, seasonal presence of Gulf sturgeon in navigation channels and barrier island passes, sea turtles' potential presence at sand mining sites in proximity to hardgrounds, and the documented takes of sea turtles at sand mining sites in North Carolina, South Carolina, and Florida, it can be expected that future maintenance dredging and dredging for beach renourishment purposes with hopper dredges in the action area will occasionally capture and entrain sea turtles and Gulf sturgeon incidental to the proposed dredging activities. Most of these entrainments can be expected to result in death of the individuals overtaken by the draghead.

In addition to hopper dredge takes, NOAA Fisheries anticipates that sea turtles may be taken by bed-leveler type dredges. The Brunswick Harbor report received in July 2003 is the first report that NOAA Fisheries received indicating a possible link between bed-leveling mechanical dredging and sea turtle takes. Although there are no confirmed reports to date which definitively implicate bed-levelers with sea turtle takes, NOAA Fisheries believes, based on the Brunswick Harbor report, that a significant possibility exists that bed-leveling mechanical dredging may kill sea turtles during leveling/cleanup operations associated with hopper dredging projects not only at Brunswick Harbor, but also in Gulf of Mexico channels and dredged-material deposition areas where bed-levelers are used. Following the Brunswick Harbor report, NOAA Fisheries issued a biological opinion on September 11, 2003, to the Savannah District COE to allow the use of bed-leveling mechanical dredging devices during the Brunswick Harbor deepening project. That Opinion anticipated and established an incidental take of sea turtles pursuant to the proposed action. In the Gulf of Mexico, NOAA Fisheries will use STSSN observer reports and evidence from strandings in proximity of dredging projects where bed-levelers are being used to determine if sufficient evidence exists to indicate that a turtle was killed by a bed-leveler. If compelling STSSN observer reports and evidence indicate that a turtle was killed by a bed-leveling type dredge, that take will be deducted from the ITS' anticipated take level for that COE District where the take occurred.

NOAA Fisheries anticipates that for the entire Gulf of Mexico from the U.S.-Mexico border to Key West, not including Key West, endangered species observers aboard COE hopper dredging operations, and STSSN personnel indirectly monitoring bed-leveler type dredging, will document the take yearly, by injury or mortality, of a maximum of approximately 40 loggerhead turtles, 20 Kemp's ridley turtles, 14 green turtles, four hawksbill turtles, and four Gulf sturgeon, and of a maximum of 300 turtles and eight Gulf sturgeon taken non-injuriously by relocation trawling. These estimates are based on factors such as documented average and maximum yearly takes during previous years, variability in sea turtle abundance and distribution, annual maintenance dredging schedules, anticipated increases in beach nourishment projects, and anticipated takes established in previous Opinions. To be conservative and account for listed species which may be taken but not documented, NOAA Fisheries assumes that an equal number of sturgeon and turtles are killed by being crushed by the deflector dragheads but are not entrained and thus are not documented, or are entrained in fragments and are not detected by hopper dredge endangered species observers, or takes occur during periods when hopper dredge endangered species observers are not required or are not present. Thus, a maximum estimate of 80 loggerhead turtles, 40 Kemp's ridleys, 28 green turtles, eight hawksbill turtles, and eight Gulf sturgeon may be killed or injured annually in COE Gulf of Mexico hopper dredging operations. NOAA Fisheries estimates that 0-2 turtles and 0-1 Gulf sturgeon will be killed or injured annually pursuant to annual relocation trawling in the Gulf of Mexico.

With the exception of the northern nesting population of loggerheads, nesting for loggerheads, Kemp's ridley, and green sea turtles has been increasing or remaining stable in the southeast United States and (in the case of Kemp's ridleys) Rancho Nuevo, Mexico, given all of the ongoing impacts to these species which includes takes through maintenance dredging and sand mining using hopper dredges. Based on information presented in the Environmental Baseline section of this Opinion, the increase in TED opening sizes associated with the final rule, published in the *Federal Register* on February 21, 2003, (68 FR 8456) is expected to allow the northern nesting population of loggerheads to increase, though all sea turtle species in the Gulf of Mexico, and Gulf sturgeon, will benefit from the enlarged openings which will enhance escapement. Similarly, the population of Gulf sturgeon appears to be stable or increasing, and recent designation of critical habitat should further aid its recovery. Except for the Mobile District which previously has not had an Opinion authorizing incidental take (though NOAA Fisheries suspects takes none-the-less occurred), the proposed action does not constitute a significant increase in the authorized take, particularly injurious or lethal take, of sea turtles or Gulf sturgeon above levels associated with past and ongoing authorized maintenance dredging and sand mining activities involving the use of hopper dredging. Further, these take levels are very small compared to other activities, such as shrimping, other commercial fisheries, and vessel collisions, which are much greater sources of sea turtle and Gulf sturgeon take and mortality. Therefore, NOAA Fisheries believes that this level of anticipated take is not likely to alter the positive population trajectories of any of these species.

Finally, the critical habitat analysis that NOAA Fisheries conducted to investigate potential project impacts to PCEs within units #8 and #11 concluded that impacts from the project would not have a measurable effects on water quality, sediment quality, migratory pathways or prey availability. This conclusion was dependent upon two important parameters: 1) channels would only be maintained, not improved, and 2) sediments removed from the channel bed would not be different from those remaining; therefore available habitat would not be modified.

6.0 Cumulative Effects

Cumulative effects are the effects of future state, local, or private activities that are reasonably certain to occur within the action area or within the range of sea turtles. 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 the ongoing human activities described in the environmental baseline. The present, major human uses of the action area are expected to continue at the present levels of intensity in the near future. Listed species of turtles, however, migrate throughout the Atlantic Ocean and Gulf of Mexico and may be affected during their life cycles by non-Federal activities outside the action area.

Throughout the coastal Gulf of Mexico the loss of thousand of acres of wetlands is occurring due to natural subsidence and erosion, as well as reduced sediment input from the Mississippi River. Impacts caused by residential, commercial, and agricultural developments appear to be the primary causes of wetland loss in Texas.

Oil spills from tankers transporting foreign oil, as well as the illegal discharge of oil and tar from vessels discharging bilge water, will continue to affect water quality in the Gulf of Mexico. Cumulatively, these sources and natural oil seepage contribute most of the oil discharged into the Gulf of Mexico. Floating tar sampled during the 1970s, when bilge discharge was still legal, concluded that up to 60% of the pelagic tars sampled did not originate from northern Gulf of Mexico coast.

Marine debris will likely persist in the action area in spite of national and international treaty prohibitions. In Texas and Florida, approximately half of the stranded turtles examined have ingested marine debris (Plotkin and Amos 1990, Bolten and Bjorndal 1991). Although few individuals are affected, entanglement in marine debris may contribute more frequently to the death of sea turtles.

Coastal runoff and river discharges carry large volumes of petrochemical and other contaminants from agricultural activities, cities, and industries into the Gulf of Mexico. The coastal waters of the Gulf of Mexico have more sites with high contaminant concentrations than other areas of the coastal United States due to the large number of waste discharge point sources. The species of turtles analyzed in this Opinion may be exposed to and accumulate these contaminants during their life cycles. A few (n=12) Gulf sturgeon have been analyzed for pesticides and heavy metals (Bateman and Brim 1994). Each individual fish had concentrations of arsenic, mercury, DDT metabolites, toxaphene, polycyclic aromatic hydrocarbons and aliphatic hydrocarbons high enough to warrant concern (USFWS et al. 1995). Specific sources were not identified.

Beachfront development, lighting, and beach erosion control all are ongoing activities along the Atlantic and Gulf coasts. These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, as conservation awareness spreads, more and more coastal cities and counties are adopting more stringent measures to protect hatchling sea turtles from the disorienting effects of beach lighting.

Because many activities that affect marine habitat involve some degree of Federal authorization (e.g., through MMS or COE), NOAA Fisheries expects that ESA section 7 will apply to most major, future actions that could affect designated Gulf sturgeon critical habitat.

State-regulated commercial and recreational fishing activities in Atlantic Ocean and Gulf of Mexico waters currently result in the incidental take of threatened and endangered species. It is expected that states will continue to license/permit large vessel and thrill-craft operations which do not fall under the purview of a Federal agency, and issue regulations that will affect fishery activities. Any increase in recreational vessel activity in inshore and offshore waters of the Gulf of Mexico and Atlantic Ocean will likely increase the number 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 NOAA Fisheries and the states on these issues should help decrease take of sea turtles caused by recreational activities. NOAA Fisheries will continue to work with coastal states to develop and refine ESA section 6 agreements and section 10 permits to enhance programs to quantify and mitigate these takes.

7.0 Conclusion

The current status of sea turtle and Gulf sturgeon populations is not likely to be appreciably affected by hopper dredging operations in the action area, as has been described in detail in Sections 3.0 and 5.0 of this Opinion. In summary, NOAA Fisheries believes that the current status of sea turtle and Gulf sturgeon populations is stable or increasing and that hopper dredge-related take levels anticipated in the Effects of the Action (Section 5) and ITS of this Opinion will not change that conclusion. NOAA Fisheries acknowledges that documented takes represent partial estimates of total takes and believes that some takes may pass undetected by observers through inflow screening devices, due to the force of the water pressure, or because the animals are killed but not entrained; NOAA Fisheries estimates that unseen (thus, undocumented) takes represent roughly 50% of total documented takes and has evaluated the effects of the action including the expected undocumented takes.

It is also NOAA Fisheries' biological opinion that following the maintenance dredging of the channels (to existing depths only without improvements) the benthic community structure will return to, or return nearly to, pre-dredging status (i.e., species diversity, species richness, species abundance) with some inherent natural variability. Those benthic prey species will then be available for the conservation of Gulf sturgeon. NOAA Fisheries also concludes that the project will not impact water quality, sediment quality, or migratory pathways essential to the conservation of Gulf sturgeon. Therefore, NOAA Fisheries concludes that, when channels within designated critical habitat are dredged to only their current depth, without improvements (i.e., deepening or widening), the project will not destroy or adversely modify designated Gulf sturgeon critical habitat.

After reviewing the current status of sea turtles and Gulf sturgeon in the Gulf of Mexico; the environmental baseline for the action area; the effects of the proposed hopper dredging activities; and the cumulative effects of future state, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion, it is NOAA Fisheries' biological opinion that the COE's hopper dredging activities, as proposed and described in the Proposed Action section of this Opinion, are not likely to jeopardize the continued existence of any listed species or destroy or adversely modify designated Gulf sturgeon critical habitat.

8.0 Incidental Take Statement

Section 9 of the ESA and Federal regulations issued pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to 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) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Galveston, New Orleans, Mobile, and Jacksonville COE Districts so that they become binding conditions of any grant or permit issued to Gulf of Mexico hopper dredge operators for the exemption in section 7(o)(2) to apply. The COE has a continuing duty to regulate the activity covered by this incidental take statement. If the COE (1) fails to assume and implement the terms and conditions, or (2) fails to require the hopper dredge operators to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) will lapse. In order to monitor the impact of incidental take, the COE must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR 402.14(i)(3)].

Only incidental take resulting from the agency action, including incidental take caused by activities approved by the agency, that are identified in this statement and that comply with the specified reasonable and prudent measures, and terms and conditions, are exempt from the take prohibition of section 9(a) of the ESA.

Based on results of previous hopper dredging activities including dredging of Gulf of Mexico and southeastern U.S. channels, NOAA Fisheries foresees that future hopper dredging activities in U.S. Gulf of Mexico navigation channels and sand mining areas may result in the injury or mortality of loggerhead, Kemp's ridley, hawksbill, and green turtles, and Gulf sturgeon. A level of incidental take is anticipated; therefore, terms and conditions necessary to minimize and monitor takes are established.

Anticipated Gulf-wide Take by Hopper Dredging Activities:

For the entire Gulf of Mexico from the U.S.-Mexico border to Key West, the annual documented COE incidental take per fiscal year, by injury or mortality, is expected to consist of twenty (20) Kemp's ridley turtles, fourteen (14) green turtles, four (4) hawksbill turtles, forty (40) loggerhead turtles, and four (4) Gulf sturgeon. This take level represents a total take per fiscal year for all channel dredging and sand mining by hopper dredges in the Gulf of Mexico by the COE's Galveston, New Orleans, Mobile, and Jacksonville Districts. Takes by bed-leveler type dredges will be more difficult to ascertain and determine responsibility for because bed-levelers do not entrain turtle parts, and no dredged materials come aboard for observers to monitor; furthermore, bed-leveler impacted turtles may not float ashore for several days, if at all. However, if compelling STSSN observer reports and evidence indicate that a turtle was killed by a bed-leveler associated with a hopper dredging project covered by this Opinion, that take will be deducted from the ITS' anticipated take level for that COE District where the take occurred.

In addition, the total anticipated annual non-injurious take by relocation trawling that is required under this ITS is expected to consist of 300 (three hundred) sea turtles, of any combination of the species, and of eight (8) Gulf sturgeon, across all the COE Districts and hopper dredging projects (the relocation trawling takes are not allocated by districts). NOAA Fisheries estimates that 0-2 turtles and 0-1 Gulf sturgeon will be killed or injured annually pursuant to annual relocation trawling in the Gulf of Mexico.

Galveston District

For the Galveston District, the annual documented incidental take by hopper dredges, by injury or mortality, is expected to consist of seven (7) Kemp's ridleys, five (5) green turtles, one (1) hawksbill, and fifteen (15) loggerhead turtles per fiscal year for all channel dredging and sand mining by hopper dredge in the Galveston District. This level of take represents the same level of take authorized by the previous Opinion. Although the annual level of hopper dredging in Freeport Channel has doubled since the previous Opinion, all takes recorded from Freeport Channel have been loggerheads and the District has never come close to reaching its anticipated take level for loggerheads, so no increase in take numbers of loggerheads or other species is expected.

New Orleans District

For the New Orleans District, the documented annual incidental take by hopper dredges, by injury or mortality, is expected to consist of seven (7) Kemp's ridleys, three (3) green turtles, one (1) hawksbill, and fifteen (15) loggerhead turtles, and one (1) Gulf sturgeon per fiscal year for all channel dredging and sand mining by hopper dredge in the New Orleans District. As in the previous Opinion, a greater number of green turtles is included in the incidental take level predicted for the Galveston District due to the greater abundance of green turtles in south Texas waters.

Mobile District (Florida Panhandle west of Aucilla River Basin to, but not including, the Mississippi River)

For the Mobile District, the documented annual incidental take by hopper dredges, by injury or mortality, is expected to consist of three (3) Kemp's ridley, three (3) green turtles, one (1) hawksbill, five (5) loggerhead turtles, and two (2) Gulf sturgeon per fiscal year for all channel dredging and sand mining by hopper dredge in the Mobile District. A greater number of Gulf sturgeon is included in the incidental take level predicted for the Mobile District than the New Orleans District due to the greater abundance of Gulf sturgeon, and larger areas of designated Gulf sturgeon critical habitat, in the former.

Jacksonville District (Florida West Coast: Aucilla River Basin to, but not including, Key West)

For the Jacksonville District, the documented annual incidental take by hopper dredges, by injury or mortality, is expected to consist of three (3) Kemp's ridleys, three (3) green turtles, one (1) hawksbill, five (5) loggerhead turtles, and one (1) Gulf sturgeon per fiscal year for all channel dredging and sand mining by hopper dredge in the Jacksonville District west of Key West (hopper dredging of Key West navigation channels is covered under the existing regional hopper dredging RBO to the COE's SAD).

Responsibility for Hopper Dredging Takes Where COE Jurisdiction is Blurred (Civil Works vs. Regulatory Projects):

As mentioned in Section 2.0, sometimes a hopper dredging activity is permitted by a COE District but the applicant/permittee is a different COE District. To ensure that the COE District ultimately responsible for authorizing a hopper dredge activity is held accountable for its permitting action which may result in a take, and to avoid confusion as to which COE District is to be charged with a take during a hopper dredging project authorized by a COE District but performed by another District or performed in another District, NOAA Fisheries has established the following guidelines for assigning take responsibility:

A protected species take shall normally be charged to the District which issues the regulatory permit for the hopper dredging. Civil works projects do not require regulatory permitting therefore civil works hopper dredging takes shall be charged to the COE District conducting or contracting the dredging project.

However, in Florida, the Mobile District will assume responsibility for (and be charged with) all takes of threatened or endangered species resulting from hopper dredging or relocation trawling activities contracted by the Mobile District even though regulatory permits for the activities may be issued by the Jacksonville District, based on a working agreement to this effect developed between the Mobile and Jacksonville Districts (Susan Rees, pers. comm. to Eric Hawk, October 30, 2003).

For example: The Jacksonville District authorizes (via regulatory permit action through a branch office of its Regulatory Division) the restoration of Pensacola Beach utilizing a hopper dredge. The Jacksonville District's Florida West Coast anticipated incidental take level ("quota") shall be charged with any takes ensuing from the hopper dredge activities even though Pensacola Beach geographically lies within the Mobile District's civil works boundaries, since the Jacksonville District has the authority to incorporate permit conditions to limit protected species take, and contracts the work.

For example: The Mobile District typically acts as construction agent for the U.S. Navy to hopper dredge the navigation channel at the Pensacola Naval Air Station ("Navy channel"), a non-civil works "regulatory" project subject to permitting by the Jacksonville District's Regulatory Division (which has regulatory permitting authority for projects in the Florida Panhandle). The Mobile District, acting for the Navy, applies for and obtains the required regulatory permit from Jacksonville District's Regulatory Division. However, the Mobile District, pursuant to the working agreement in place between the Mobile and Jacksonville Districts, shall be charged for any takes ensuing from that hopper dredging activity.

9.0 Reasonable and Prudent Measures

Regulations (50 CFR 402.02) implementing section 7 of the ESA define reasonable and prudent measures as actions the Director believes necessary or appropriate to minimize the impacts, i.e., amount or extent, of incidental take. The reasonable and prudent measures that NOAA Fisheries believes are necessary to minimize the impacts of hopper dredging in the Gulf of Mexico have been discussed with the COE and include use of temporal dredging windows, intake and overflow screening, use of sea turtle deflector dragheads, observer and reporting requirements, and sea turtle relocation trawling. The following reasonable and prudent measures 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. These restrictions remain valid until reinitiation and conclusion of any subsequent section 7 consultation.

Seasonal Dredging Windows, Observer Requirements, Deflector Dragheads, and Relocation Trawling[5]

---

[5]The COE Wilmington District's sidecast dredges FRY, MERRITT, and SCHWEIZER, and split-hull hopper dredge CURRITUCK, are exempt from the above hopper dredging requirements (operating windows, deflectors, screening, observers, reporting requirements, etc.). Their small size and operating characteristics including small draghead sizes [2-ft by 2-ft, to 2-ft by 3-ft], small draghead openings [5-in by 5-in to 5 in by 8 in], small suction intake pipe diameters [10-14 in], and limited draghead suction [350-

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 seasonal dredging windows and observer monitoring requirements, deflector dragheads, and conditions and guidelines for relocation trawling, which NOAA Fisheries' believes are necessary to minimize effects of these removals on listed sea turtle species that occur in inshore and nearshore Gulf and South Atlantic waters.

Temperature- and date-based dredging windows:
Both the Mobile and Jacksonville Districts expressed comments opposing NOAA Fisheries' imposition of seasonal dredging windows in their respective Gulf of Mexico dredging areas. In their November 28, 2000, BA on their Florida west coast hopper dredging activities, the Jacksonville District indicated that sea turtles are present year-round in the Gulf, so windows would only be of limited effectiveness. In their October 30, 2002, comments to NOAA Fisheries, the Mobile District noted it did not want to be restricted to seasonal hopper dredging windows, indicating that these would potentially seriously and detrimentally impact its ability to complete its operations and maintain Federal navigation projects due to "no excess of large dredges of the type required to perform maintenance of most Federal projects" and other reasons related to dredging industry capacity, downsizing, "loss of production" associated with the deflector draghead, and safety concerns.

Sea turtles generally move inshore with warming waters and offshore with cooling waters. In East Coast channels, Dickerson et al. (1995) found reduced sea turtle abundance with water temperatures less than 16°C. They found that 1,008 trawls conducted at or below 16°C captured 22 turtles (4.4 per cent), while 1,791 trawls conducted above 16°C resulted in 473 (95.6 percent) captures. Dickerson et al. also found that sea turtles tend to avoid water temperatures less than 15°C; however, hopper dredging Kings Bay, Georgia between March 1-12, 1997 with surface water temperatures of 57-58°F (13.9-14.4°C) resulted in 11 turtle takes in nine days (NMFS 1997).

More recently, the Savannah District COE (COE 2003) reported that the average surface temperature at which recent hopper dredge turtle takes have occurred in Brunswick is 57.7°F (14.3°C) and that "there are scattered takes at lower temperatures than turtles would normally be expected to occur" but that "These lower temperatures may not have played a significant role in those takes." The lowest temperature at which multiple takes have occurred in Brunswick in 2003 is 57°F (13.9°C).

Recognizing the relationship between water temperature and sea turtle presence and based on work by the NOAA Fisheries' Galveston Laboratory (Renaud et al. 1994, 1995) funded by the COE, NOAA Fisheries wrote in its September 22, 1995 RBO to the Galveston and New Orleans Districts that sea turtles might be taken by hopper dredges "in all ship channels in the northern Gulf when temperatures exceed 12°C," and that "Lacking seasonal water temperature data, NMFS believes takes may occur from April through November northeast of Corpus Christi, Texas." Consequently, Term and Condition No. 3 of the 1995 RBO required that observers be aboard hopper dredges year-round from Corpus Christi southwest to the Mexican border, but "If no turtle take is observed in December, then observer coverage can be terminated during January and February or until water temperatures again reach 12°." It also required that "In channels

---

400 hp]) have been previously determined by NOAA Fisheries to not adversely affect listed species (March 9, 1999, ESA consultation with COE Wilmington District, incorporated herein by reference). The aforementioned vessels and commercial hopper and sidecast dredges of the same or lesser sizes and operating characteristics working in the Gulf of Mexico would be considered similarly exempt by NOAA Fisheries' SERO after consultation with SERO.

northeast of Corpus Christi (except for MR-SWP), observers shall be aboard whenever surface water temperatures are 12°C or greater, and/or between April 1 and November 30."

NOAA Fisheries published a final rule (67 FR 71895, December 3, 2002) effective January 2, 2003, to reduce the impact of large-mesh gillnet fisheries on the Atlantic Coast on sea turtles. This rule was directed primarily at the monkfish fishery, which uses large-mesh gillnet gear and operates in the area when sea turtles are present. The rule reduces impacts on endangered and threatened species of sea turtles by closing portions of the Mid-Atlantic Exclusive Economic Zone (EEZ) waters to fishing with gillnets with a mesh size larger than 8-inch (20.3-cm) stretched mesh. The timing of the restrictions was based upon an analysis of sea surface temperatures for the above areas. Sea turtles are known to migrate into and through these waters when the sea surface temperature is 11°C or greater (Epperly and Braun-McNeill 2002). The January 15 date for the re-opening of the areas north of Oregon Inlet, North Carolina to the large-mesh gillnet fisheries was also based upon the 11°C threshold and is consistent with the seasonal boundary established for the summer flounder fishery-sea turtle protection area (50 CFR 223.206(d)(2) (iii)(A)). In summary, NOAA Fisheries believes that the 11°C threshold established to protect East Coast sea turtles is reasonable and prudent to protect sea turtles in the Gulf of Mexico from hopper dredging operations.

Temperature- and date-based dredging windows appear to have been very effective in reducing sea turtle entrainments. Observer requirements and monitoring including assessment and relocation trawling have provided valuable real-time estimates of sea turtle abundance, takes, and distribution which have been helpful to COE project planning efforts. Evidence that the windows and observer requirements are effective and valuable is that neither the Galveston or New Orleans District's hopper dredging projects have exceeded their anticipated incidental takes since their combined RBO was issued in 1995; SAD has not exceeded its anticipated incidental take since its RBO was amended in 1997.

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 and Gulf sturgeon mortality. NOAA Fisheries 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 can be identified as from sea turtle or sturgeon species. However, this Opinion estimates that with 4-inch inflow screening in place, the observers probably detect and record at least 50% of total mortality.

Relocation trawling has proved to be a useful conservation tool in most dredging projects where it has been implemented. The September 22, 1995, RBO 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 NOAA Fisheries (Amendment No. 1, June 13, 2002) to change the Conservation Recommendation to a Term and Condition of the RBO. Overall, it is NOAA Fisheries' opinion that the COE Districts choosing to implement relocation trawling have benefitted 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 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 hoppers 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. Most recently, 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 (Trish Bargo, October 27, 2003, pers. comm. to Eric Hawk).

This Opinion authorizes the per-fiscal-year non-lethal non-injurious take (minor skin abrasions resulting from trawl capture are considered non-injurious), external flipper-tagging, and taking of tissue samples of 300 sea turtles and eight Gulf sturgeon in association with all relocation trawling conducted by the COE throughout the Gulf of Mexico. This take shall not be broken down by District but rather is a Gulf-wide take limit. This take is limited to relocation trawling conducted during the 0-3 days immediately preceding the start of hopper dredging (as a means to determine/reduce the initial abundance of sea turtles in the area and determine if additional trawling efforts are needed), and during actual hopper dredging. Relocation trawling performed to reduce endangered species/hopper dredge interactions is subject to the requirements detailed in the terms and conditions of this Opinion.

NOAA Fisheries estimates that 0-2 turtles and 0-1 Gulf sturgeon will be killed or injured annually pursuant to annual relocation trawling in the Gulf of Mexico. Lethal or injurious takes which result from relocation trawling (including capturing, handling, weighing, measuring, tagging, holding, and releasing) are limited to one sea turtle and one Gulf sturgeon per District per fiscal year and will be subtracted from (counted against) the authorized, anticipated take levels discussed previously for hopper dredging. For example: a Kemp's ridley injury or lethal take during a COE District's relocation trawling effort shall be counted as a documented take against that District's fiscal year anticipated take level for that species. NOAA Fisheries shall be immediately notified of any mortalities or injuries sustained by protected species during relocation/assessment trawling.

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 WES 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, two 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 (WES, Sea Turtle Project Progress Report, June 1993)." 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, with the exception of the Mobile District.

In Gulf of Mexico coastal waters, evidence indicates that turtles are present year-round, further arguing for year-round deflector draghead use by all COE Districts of the Gulf of Mexico. Recent comprehensive NOAA Fisheries' Southeast Fishery Science Center (SEFSC) review and analyses (unpublished data, December 2002: Environmental Assessment/Regulatory Impact Review of Technical Changes to the Turtle Excluder Device (TED) Regulations to Enhance Turtle Protection in the Southeastern United States) of seasonal sea turtle distribution and strandings throughout the Gulf of Mexico (including coastal waters dredged by the Mobile District) noted that "Aerial surveys and observer data have indicated the presence of turtles in areas where strandings data are sparse" and "Turtles were in all areas at all times." (September 13, 2002, e-mail, Epperly to Hawk). NOAA Fisheries' SEFSC's sea turtle team leader Epperly also recommended against hopper dredges operating in those same areas "without monitoring, relocation, and specialized gear (i.e., deflectors) on the dragheads."

It wasn't until late-summer 2002 that the Mobile District started requiring observers and screening on its hopper dredges. REMSA recently completed ten days of 24-hr relocation trawling/dredged material monitoring for the Mobile District during ten days of emergency maintenance hopper dredging of the Mobile Bay ship channel (July 10-20, 2003). No sea turtle specimens or parts of specimens were observed during the ten days by either the relocation trawler observers or the shipboard dredge observers. Dredging is currently conducted in the Mobile District with onboard observers and 4-inch inflow screening but without deflector dragheads (Ladner, pers. comm. to Hawk, November 26, 2002). Mobile District, in written comments dated October 30, 2002, on a draft version of the present Opinion, noted that "The District recognizes the benefits of deflector dragheads to conservation of the species in areas where sea turtle takes occur. However, dragheads reduce dredging efficiency and result in dredges being onsite for a longer period of time. Consequently, the District finds no overriding need to utilize deflectors until it is proven, through use of screens and observers, that the Mobile District actually takes sea turtles during normal operations."

Habitat Protection Buffers
COE Jacksonville District biologists expressed concern (Yvonne Haberer, email to Eric Hawk, April 2003; Terri Jordan, pers. comm. August 11, 2003) over a NOAA Fisheries' draft version of the current Opinion proposed requirement of a 200-m buffer zone around hardgrounds in the vicinity of COE-proposed sand mining areas off Florida. In discussions over the Pinellas County Shore Protection Project, the COE noted that NOAA Fisheries has previously required only a 200-ft zone around hardgrounds adjacent to COE sand mining operations in the Gulf of Mexico. NOAA Fisheries' Protected Resources Division consulted with NOAA Fisheries Habitat Conservation Division, which stated that as a general rule, buffer zones should not be less than 400 feet to protect essential fish habitat. In its response to the COE, which included a request for additional information (Eric Hawk email to Yvonne Haberer, May 14, 2003) which was never received, NOAA Fisheries' Protected Resources Division concluded that a 200-ft buffer was inadequate and that a 200-meter buffer zone was appropriate to protect sea turtles which may be foraging on or around hardgrounds adjacent to mining sites from hopper dredge entrainment. NOAA Fisheries noted that hopper dredge vessels are large (typically 300-400 ft long); limited in their ability to maneuver; and given other variable factors such as wind, tide, weather, sea state, currents, operator fatigue, operator error, and instrument error, a 200-ft margin of safety around hardgrounds was inadequate to protect NOAA Fisheries trust resources and sea turtles which could be expected to frequent hardgrounds and their vicinity. Subsequently, however, conversations with hopper dredge industry officials and dredge operators have led NOAA Fisheries to conclude that based on advances in hopper dredge construction, including the use of highly maneuverable Z-drives (on some dredges), enhanced station-keeping ability, and industry-standard navigation practices and technologies including routine use of differential global positioning systems (DGPS), dredge operators will be able to routinely and safely maintain desired safe distances from hardgrounds that are marked on their charts (E. Hawk, August 14 and 18, 2003, pers. comms. with R. Richardson, Manson Dredging; Mark Sickles, Dredge Contractors of America; and W. Murcheson, NATCO Dredging). NOAA Fisheries has determined that 400 feet is an adequate, reasonable buffer zone that should be maintained around hardgrounds, to protect endangered living resources–i.e., sea turtles that

may be foraging in their vicinity. Four hundred feet also provides the additional benefit of protecting hardgrounds from some of the probable adverse effects of sedimentation from the dredged material plume. For example, a generic test case numerical model simulation of a typical situation representative of hopper dredging of MMS shoals using the Trailing Suction Hopper Dredge Plume Model developed by Baird, Inc., for MMS, using inputted variables of a cross current of 20 cm/s, fine sand, two million cubic meter project, and a water depth of about 15 to 20 m, gave a sedimentation footprint of 200 m beyond the boundary of the dredge area (Rob Nairn, October 3, 2003, pers. comm. to Eric Hawk).

Summary

NOAA Fisheries has carefully reviewed and fully considered these and all other comments received from the affected COE Districts; however, in summary, after review of WES studies, SEFSC survey data, and based on past experience, NOAA Fisheries believes that seasonal dredging windows, deflector dragheads, observer and screening requirements, and relocation trawling have proved convincingly over the last decade to be an excellent combination of reasonable and prudent measures for minimizing the number and impact of sea turtle takes, enabling NOAA Fisheries to assess the quantity of turtles being taken, and allowing the affected COE Districts (Wilmington, Charleston, Savannah, Jacksonville, New Orleans, and Galveston) to meet their essential dredging requirements to keep Federal navigation channels open.

There are increased costs associated with observers and relocation trawling (current estimates are $3,500-$5,000/day for 24 hours of relocation trawling, $150-$200/day for a hopper dredge endangered species observer); delays sometimes occur, particularly when two turtles are taken in 24 hours, or when clay-like materials clog the inflow screening boxes; and dredging projects may take longer to complete. However, overall, NOAA Fisheries believes that 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; increased production costs, including costs of observers and relocation trawlers, pale in comparison to overall project costs; and NOAA Fisheries' experience over the past decade with the COE's SAD Districts and the Gulf of Mexico's Galveston and New Orleans Districts 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.

NOAA Fisheries considers that PIT tagging, external flipper tagging, and tissue sampling of turtles captured pursuant to relocation trawling, including genetic analysis of tissue samples taken from dredge- and trawl-captured turtles, will provide benefits to the species by providing data which will enable NOAA Fisheries to make determinations on what sea turtle stocks are being impacted, and how that may change over time as the population growth rates change among the different stocks (Sheryan Epperly, pers. comm. to Eric Hawk).

NOAA Fisheries estimates that 150-300 sea turtle tissue samples will be taken annually in the Gulf of Mexico during COE dredging and relocation trawling operations. Depending on the species, a few years of collection will provide sufficient sample size to assess stock composition (Peter Dutton, pers. comm. to Eric Hawk). Samples will continue to be collected and archived, until a follow-up analysis can be done two to three years after that if it is deemed necessary. NOAA Fisheries estimates that genetic analysis of tissue samples, including labor, costs about $100-150 per sample (Peter Dutton, pers. comm. to Eric Hawk); thus, the cost of analysis of 300 samples will be between $30,000 and $45,000. NOAA Fisheries believes that, minimally, the combined COE Gulf of Mexico Districts affected by this Opinion should provide $10,000 to help defray the cost of analysis of the first 300 samples taken. COE funds should be provided to NOAA

Fisheries' Southwest Fisheries Center's Dr. Peter Dutton, preferably in a lump-sum, one-time payment as a part of a Memorandum of Understanding (MOU) to be developed between Dr. Dutton and the COE's combined Gulf of Mexico Districts (similar to the current MOU nearing completion between the COE's South Atlantic Division and the Southwest Fisheries Science Center for hopper dredging/relocation trawling conducted by the South Atlantic Divisions four Atlantic Districts). After the initial financial contribution by the COE, NOAA Fisheries would continue to archive and store samples gathered by the COE but the COE's responsibility would be limited to taking the samples and shipping them to NOAA Fisheries' Southwest Fisheries Science Center. Incorporation of this funding requirement as a reasonable and prudent measure of this Opinion will result in the gathering of knowledge that is expected to reduce the effect of the takes from Gulf of Mexico dredging projects.

The dredging windows set forth in the terms and conditions of the 1995 Gulf of Mexico hopper dredging RBO, while very strongly encouraged by NOAA Fisheries for previously stated reasons, were ultimately discretionary activities by the COE and could be deviated from by the SAD or the Galveston or New Orleans Districts when they deemed essential or necessary after consultation with NOAA Fisheries, though this was infrequent. This flexibility is also stipulated in the Proposed Action section of the present Opinion which applies to all four COE Districts. Terms and conditions of the present Opinion remain largely the same, with the following significant exceptions:

1) The allowable window for hopper dredging has been extended to include the Mobile and Jacksonville Districts so that the December-March window is now Gulf-wide, from the Texas-Mexico border to Key West channels;

2) Previous temperature requirements of Term and Condition No. 3 of the 1995 RBO (i.e., "If no turtle take is observed during December, observer coverage can be terminated during January and February or until water temperatures again reach 12°C; In channels northeast of Corpus Christi, Texas [except for Southwest Pass as discussed below], observers shall be aboard whenever surface water temperatures are 12° or greater, and/or between April 1 and November 30.") have been modified downward to 11°C based on new sea turtle distribution information which indicates that sea turtles are more tolerant of cold than was previously thought. The discussion of temperature/sea turtle distribution supporting this change is incorporated herein by reference to the Monkfish Biological Opinion (dated April 14, 2003, prepared by NOAA Fisheries Northeast Region).

3) The September 22, 1995, RBO 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 NOAA Fisheries SER (Amendment No. 1, June 13, 2002), to change the Conservation Recommendation to a Term and Condition of the RBO. Term and Condition No. 10 of the amended RBO specified conditions under which relocation trawling "should be considered" and subject to what precautions it should be carried out, and authorized unlimited non-lethal, non-injurious take of sea turtles and Gulf sturgeon in association with relocation trawling deemed necessary the by COE. This amount of discretion has since been determined to be inappropriate for a non-discretionary term and condition of an ITS. Thus, the present Opinion's requirement for relocation trawling is more non-discretionary than as written in Amendment No. 1 in that it requires the use of relocation trawlers under specific conditions as a way to minimize turtle interactions, rather than only requiring that it be "considered" by the COE.

4) In the present Opinion, the COE Districts are authorized to request waivers from the relocation trawling requirement (which may be delivered and responded to by both agencies via electronic mail) for projects where the COE Districts do not feel relocation trawling is feasible, necessary or warranted.

5) The Districts are required to fund the cost of tissue sampling and genetic analyses of tissue samples from turtles taken during projects in their respective Districts.

The following terms and conditions implement the reasonable and prudent measures discussed above:

Terms and Conditions

Hopper Dredging: Hopper dredging activities in Gulf of Mexico waters from the Mexico-Texas border to Key West, Florida up to one mile into rivers shall be completed, whenever possible, between December 1 and March 31, when sea turtle abundance is lowest throughout Gulf coastal waters. Hopper dredging of Key West channels is covered by the existing August 25, 1995, RBO to the COE's SAD. The COE shall discuss with NOAA Fisheries why a particular project cannot be done within the December 1-March 31 "window."

2. *Non-hopper Type Dredging*: Pipeline or hydraulic dredges, because they are not known to take turtles, must be used whenever possible between April 1 and November 30 in Gulf of Mexico waters up to one mile into rivers. This should be considered particularly in channels such as those associated with Galveston Bay and Mississippi River - Gulf Outlet (MR-GO), where lethal takes of endangered Kemp's ridleys have been documented during summer months, and Aransas Pass, where large numbers of loggerheads may be found during summer months. In the MR-GO, incidental takes and sightings of threatened loggerhead sea turtles have historically been highest during April and October.

3. *Annual Reports*: The annual summary report, discussed below (#9), must give a complete explanation of why alternative dredges (dredges other than hopper dredges) were not used for maintenance dredging of channels between April and November.

4. *Observers*: The COE shall arrange for NOAA Fisheries-approved observers to be aboard the hopper dredges to monitor the hopper spoil, screening, and dragheads for sea turtles and Gulf sturgeon and their remains.

   a. Brazos Santiago Pass east to Key West, Florida: Observer coverage sufficient for 100% monitoring (i.e., two observers) of hopper dredging operations is required aboard the hopper dredges year-round from Brazos Santiago Pass to (not including) Key West, Florida between April 1 and November 30, and whenever surface water temperatures are 11°C or greater.

   b. Observer coverage of hopper dredging of sand mining areas shall ensure 50% monitoring (i.e., one observer).

   c. Observers are not required at any time in Mississippi River - Southwest Pass (MR-SWP).

5. *Operational Procedures*: During periods in which hopper dredges are operating and NOAA Fisheries-approved observers are *not* required, (as delineated in #4 above), the appropriate COE District must:

a. Advise inspectors, operators and vessel captains about the prohibitions on taking, harming, or harassing sea turtles

b. Instruct the captain of the hopper dredge to avoid any turtles and whales encountered while traveling between the dredge site and offshore disposal area, and to immediately contact the COE if sea turtles or whales are seen in the vicinity.

c. Notify NOAA Fisheries if sea turtles are observed in the dredging area, to coordinate further precautions to avoid impacts to turtles.

d. Notify NOAA Fisheries immediately by phone (727/570-5312) or fax (727/570-5517) if a sea turtle or Gulf sturgeon is taken by the dredge.

6. *Screening*: When sea turtle observers are required on hopper dredges, 100% inflow screening of dredged material is required and 100% overflow screening is recommended. If conditions prevent 100% inflow screening, inflow screening may be reduced gradually, as further detailed in the following paragraph, but 100% overflow screening is then required. NOAA Fisheries must be consulted prior to the reductions in screening and an explanation must be included in the dredging report.

a. Screen Size: The hopper's inflow screens should have 4-inch by 4-inch screening. If the COE, 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% overflow screening is mandatory. The COE shall notify NOAA Fisheries 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: NOAA Fisheries 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.

c. Exemption - MR-SWP: Screening is not required at any time in MR-SWP.

7 *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.

8. *Sea Turtle Deflecting Draghead*: A state-of-the-art rigid deflector draghead must be used on all hopper dredges in all Gulf of Mexico channels and sand mining sites at all times of the year except that the rigid deflector draghead is not required in MR-SWP at any time of the year.

9. *Dredge Take Reporting*: Observer reports of incidental take by hopper dredges must be faxed to NOAA Fisheries' Southeast Regional Office (727-570-5517) by onboard endangered species observers within 24 hours of any sea turtle, Gulf sturgeon, or other listed species take observed.

A preliminary report summarizing the results of the hopper dredging and any documented sea turtle or Gulf sturgeon takes must be submitted to NOAA Fisheries within 30 working days of completion of any 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 (if relocation trawling, the number and species of turtles relocated), screening type (inflow, overflow) utilized, daily water temperatures, name of dredge, names of endangered species observers, percent observer coverage, and any other information the COE deems relevant.

An annual report (based on fiscal year) must be submitted to NOAA Fisheries summarizing hopper dredging projects and documented incidental takes.

10. *Sea Turtle Strandings*: The COE 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/sturgeon 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 NOAA Fisheries' Southeast Regional Office. Because of different possible explanations for, and subjectivity in the interpretation of potential causes of strandings, these strandings will not normally be counted against the COE's take limit; however, if compelling STSSN observer reports and evidence indicate that a turtle was killed by a hopper dredge or a bed-leveling type dredge, that take will be deducted from the ITS' anticipated take level for that COE District where the take occurred.

11 *Reporting - Strandings*: Each COE District shall provide NOAA Fisheries' Southeast Regional Office with an annual report detailing incidents, with photographs when available, of stranded sea turtles and Gulf sturgeon that bear indications of draghead impingement or entrainment. This reporting requirement may be included in the end-of-year report required in Term and Condition No. 9, above.

12. *District Annual Relocation Trawling Report*: Each COE District shall provide NOAA Fisheries' Southeast Regional Office with end-of-project reports within 30 days of completion of relocation trawling projects, and an annual report summarizing relocation trawling efforts and results within their District. The annual report requirement may be included in the end-of-year report required in Term and Condition # 9, above.

Conditions Requiring Relocation Trawling: Handling of sea turtles captured during relocation trawling in association with hopper dredging projects in Gulf of Mexico navigation channels and sand mining areas shall be conducted by NOAA Fisheries-approved endangered species observers. Relocation trawling shall be undertaken by the COE at all projects where <u>any</u> of the following conditions are met; however, other ongoing projects not meeting these conditions are not required to conduct relocation trawling:

a. Two or more turtles are taken in a 24-hour period in the project.

b. Four or more turtles are taken in the project.

c. 75% of a District's sea turtle species quota for a particular species has previously been met.

14. *Relocation Trawling Waiver*: For individual projects the affected COE District may request by letter to NOAA Fisheries a waiver of part or all of the relocation trawling requirements. NOAA Fisheries will consider these requests and decide favorably if the evidence is compelling.

15. *Relocation Trawling - Annual Take Limits*: This Opinion authorizes the annual (by fiscal year) take of 300 sea turtles (of one species or combination of species) and eight Gulf sturgeon by duly-permitted, NOAA Fisheries-approved observers in association with all relocation trawling conducted or contracted by the four Gulf of Mexico COE Districts to temporarily reduce or assess the abundance of these listed species during (and in the 0-3 days immediately preceding) a hopper dredging project in order to reduce the possibility of lethal hopper dredge interactions, subject to the following conditions:

a. *Trawl Time*: Trawl tow-time duration shall not exceed 42 minutes (doors in - doors out) and trawl speeds shall not exceed 3.5 knots.

b. *Handling During Trawling*: Sea turtles and sturgeon captured pursuant to relocation trawling 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 IV).

c. *Captured Turtle Holding Conditions*: Captured turtles shall be kept moist, and shaded whenever possible, until they are released.

d. *Weight and Size Measurements*: All turtles shall be measured (standard carapace measurements including body depth) and tagged, and weighed when safely possible, prior to release; Gulf sturgeon shall be measured (fork length and total length) and–when safely possible–tagged, weighed, and a tissue sample taken prior to release. Any external tags shall be noted and data recorded into the observers log. Only NOAA Fisheries-approved observers or observer candidates in training under the direct supervision of a NOAA Fisheries-approved observer shall conduct the tagging/measuring/weighing/tissue sampling operations.

e. *Take and Release Time During Trawling - Turtles*: Turtles shall be kept no longer than 12 hours prior to release and shall be released not less than three nautical miles (nmi) from the dredge site. If two or more released turtles are later recaptured, subsequent turtle captures shall be released not less than five nmi away. If it can be done safely, turtles may be transferred onto another vessel for transport to the release area to enable the relocation trawler to keep sweeping the dredge site without interruption.

f. *Take and Release Time During Trawling - Gulf Sturgeon*: Gulf sturgeon shall be released immediately after capture, away from the dredge site or into already dredged areas, unless the trawl vessel is equipped with a suitable (not less than: 2 ft high by 2 ft wide by 8 ft long), well-aerated seawater holding tank where a maximum of one sturgeon may be held for not longer than 30 minutes before it must be released or relocated away from the dredge site.

g. *Injuries and Incidental Take Quota*: Any protected species injured or killed during or as a consequence of relocation trawling shall count toward the appropriate COE District's incidental take quota. Minor skin abrasions resulting from trawl capture are considered non-injurious. Injured sea turtles shall be immediately transported to the nearest sea turtle rehabilitation facility.

h. *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 NOAA Fisheries-approved endangered 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.

i. *Gulf Sturgeon Tagging*: Tagging of live-captured Gulf sturgeon may also be done under the permitting authority of this Opinion; however, it may be done only by personnel with prior fish tagging experience or training, and is limited to external tagging only, unless the observer holds a valid sturgeon research permit (obtained pursuant to section 10 of the ESA, from the NOAA Fisheries' Office of Protected Resources, Permits Division) authorizing sampling, either as the permit holder, or as designated agent of the permit holder.

j. *PIT-Tag Scanning*: All sea turtles captured by relocation trawling (or dredges) shall be thoroughly scanned for the presence of PIT tags prior to release using a scanner powerful enough to read dual frequencies (125 and 134 kHz) and read tags deeply embedded deep in muscle tissue (e.g., manufactured by Biomark or Avid). Turtles which scans show have been previously PIT tagged shall never-the-less be externally flipper tagged. The data collected (PIT tag scan data and external tagging data) shall be submitted to NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149. All data collected shall be submitted in electronic format within 60 working days to Lisa.Belskis@noaa.gov.

k. *CMTTP:* External flipper tag and PIT tag data generated and collected by relocation trawlers shall also be submitted to the Cooperative Marine Turtle Tagging Program (CMTTP), on the appropriate CMTTP form, at the University of Florida's Archie Carr Center for Sea Turtle Research.

l. *Tissue Sampling*: All live or dead sea turtles captured by relocation trawling or dredging shall be tissue-sampled prior to release, according to the protocols described in Appendix II or Appendix III of this Opinion. Tissue samples shall be sent within 60 days of capture to: NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149. All data collected shall be submitted in electronic format within 60 working days to Lisa.Belskis@noaa.gov. This Opinion serves as the permitting authority for any NOAA Fisheries-approved endangered species observers aboard relocation trawlers or hopper dredges to tissue-sample live- or dead-captured sea turtles, without the need for a section 10 permit.

m. *Cost Sharing of Genetic Analysis*: The COE's Gulf of Mexico Districts shall combine to provide a one-time payment of $10,000 to NOAA Fisheries to share the cost of NOAA-Fisheries analysis of 300 tissue samples taken during COE hopper dredging/trawling operations in the Gulf of Mexico. This cost is currently estimated by NOAA Fisheries to be about $100-150 per sample, or $30,000-$45,000. COE funds shall be provided to NOAA Fisheries' Southwest Fisheries Center's Dr. Peter Dutton as a part of a Memorandum of Understanding (MOU) to be developed between Dr. Dutton and the COE's combined Gulf of Mexico Districts and Divisions within six months of the issuance of this Opinion.

n. *PIT Tagging:* PIT tagging is not required or authorized for, and shall not be conducted by, ESOs who do not have 1) section 10 permits authorizing said activity and 2) prior training or experience in said activity; however, if the ESO has received prior training in PIT tagging procedures and is also authorized to conduct said activity by a section 10 permit, then the ESO **must** PIT tag the animal prior to release (in addition to the standard external flipper tagging). PIT tagging must then be performed in accordance with the protocol detailed at NOAA Fisheries' Southeast Science Center's webpage: http://www.sefsc.noaa.gov/seaturtlefisheriesobservers.jsp. (See Appendix C on SEC's "Fisheries Observers" webpage). 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 mHz tag), then insert one in the other shoulder.

o. *Other Sampling Procedures*: All other tagging and external or internal sampling procedures (e.g., PIT tagging, blood letting, laparoscopies, anal and gastric lavages, mounting satellite or radio transmitters, etc.) performed on live sea turtles or live sturgeon are **not permitted under this Opinion unless** the observer holds a valid sea turtle or sturgeon research permit (obtained pursuant to section 10 of the ESA, from the NOAA Fisheries' Office of Protected Resources, Permits Division) authorizing the activity, either as the permit holder, or as designated agent of the permit holder.

p. *Handling Fibropapillomatose Turtles*: Observers handling sea turtles infected with fibropapilloma tumors shall either: 1) clean all equipment that comes in contact with the turtle (tagging equipment, tape measures, etc.) with mild bleach solution, between the processing of each turtle or 2) maintain a separate set of sampling equipment for handling animals displaying fibropapilloma tumors or lesions. Tissue/tumor samples shall be sent within 60 days of capture to: NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149. All data collected shall be submitted in electronic format within 60 working days to Lisa.Belskis@noaa.gov. This Opinion serves as the permitting authority for all NOAA Fisheries-approved endangered species observers aboard a relocation trawler or hopper dredge to tissue-sample fibropapilloma-infected sea turtles without the need for a section 10 permit.

16. *Hardground Buffer Zones*: All dredging in sand mining areas will be designed to ensure that dredging will not occur within a minimum of 400 feet from any significant hardground areas or bottom structures that serve as attractants to sea turtles for foraging or shelter. NOAA Fisheries considers (for the purposes of this Opinion only) a significant hardground in a project area to be one that, over a horizontal distance of 150 feet, has an average elevation above the sand of 1.5 feet or greater, and has algae growing on it. The COE Districts shall ensure that sand mining sites within their Districts are adequately mapped to enable the dredge to stay at least 400 feet from these areas. If the COE is uncertain as to what constitutes significance, it shall consult with NOAA

Fisheries' Habitat Conservation Division and NOAA Fisheries' Protected Resources Division for clarification and guidance.

17. *Training - Personnel on Hopper Dredges*: The respective COE Districts 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 each 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.

18. *Dredge Lighting*: From May 1 through October 31, sea turtle nesting and emergence season, all lighting aboard hopper dredges and hopper dredge pumpout barges operating within three nmi of sea turtle nesting beaches shall be limited to the minimal lighting necessary to comply with U.S. Coast Guard and/or OSHA requirements. All non-essential lighting on the dredge and pumpout barge shall be minimized through reduction, shielding, lowering, and appropriate placement of lights to minimize illumination of the water to reduce potential disorientation effects on female sea turtles approaching the nesting beaches and sea turtle hatchlings making their way seaward from their natal beaches.

10.0 Conservation Recommendations

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

Channel Conditions and Seasonal Abundance Studies: Channel-specific studies should be undertaken to identify seasonal relative abundance of sea turtles and Gulf sturgeon within Gulf of Mexico channels. The December 1 through March 31 dredging window and associated observer requirements listed above may be adjusted (after consultation and authorization by NOAA Fisheries) on a channel-specific basis, if (a) the COE can provide sufficient scientific evidence that sea turtles and Gulf sturgeon are not present or that levels of abundance are extremely low during other months of the year, or (b) the COE can identify seawater temperature regimes that ensure extremely low abundance of sea turtles or Gulf sturgeon in coastal waters, and can monitor water temperatures in a real-time manner. Surveys may indicate that some channels do not support significant turtle populations, and hopper dredging in these channels may be unrestricted on a year-round basis, as in the case of MR-SWP. To date, sea turtle deflector draghead efficiency has not reached the point where seasonal restrictions can be lifted.

2. *Draghead Modifications and Bed Leveling Studies*: The New Orleans, Galveston, Mobile, and Jacksonville Districts should supplement the efforts of SAD and WES 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.

3. *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. NOAA Fisheries should be consulted regarding the development of a protocol for draghead evaluation tests. NOAA Fisheries recommends that the COE's Galveston, New Orleans, Mobile, and Jacksonville Districts coordinate with ERDC, SAD, 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 and Gulf sturgeon takes.

4. *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 and Gulf sturgeon takes by hopper dredge. Observation of overflow and inflow screening is only partially effective and provides only partial estimates of total sea turtle and Gulf sturgeon mortality.

   Overflow Screening: The COE should encourage dredging companies to develop or modify existing overflow screening methods on their company's dredge vessels for maximum effectiveness of screening and monitoring. Horizontal overflow screening is preferable to vertical overflow screening because NOAA Fisheries considers that horizontal overflow screening is significantly more effective at detecting evidence of protected species entrainment than vertical overflow screening.

   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.

5. *Section 10 Research Permits and Relocation Trawling*: NOAA Fisheries recommends that the COE's Galveston, New Orleans, Mobile, and Jacksonville Districts, either singly or combined, apply to NOAA Fisheries for an ESA section 10 research permit to conduct endangered species research on species incidentally captured during relocation trawling. For example, satellite tagging of captured turtles could enable the COE Districts to gain important knowledge on sea turtle seasonal distribution and presence in navigation channels and sand mining sites 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 Districts with the permit application process.

6. *Draghead Improvements - Water Ports*: NOAA Fisheries recommends that the COE's Gulf of Mexico Districts 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.

NOAA Fisheries supports and recommends the implementation of proposals by ERDC and SAD personnel for various draghead modifications to address scenarios where turtles may be entrained during hopper dredging (Dickerson and Clausner 2003). These include: a) an adjustable visor; b) water jets for flaps to prevent plugging and thus reduce the requirement to lift the draghead off the bottom; and c) 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.

7. *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.

8. *Sedimentation Limits to Protect Resources (Hardbottoms/Reefs)*: NOAA Fisheries recommends water column sediment load deposition rates of no more than 200 $mg/cm^2/day$, averaged over a 7-day period, to protect coral reefs and hard bottom communities from dredging-associated turbidity impacts to listed species foraging habitat.

9. *Boca Grande Pass - Conditions*: If the COE's Jacksonville District decides to renew dredging permits for the Boca Grande Pass, NOAA Fisheries recommends that the District conduct or sponsor a Gulf sturgeon study, including gillnetting and tagging utilizing ultrasonic and radio transmitters, and mtDNA sampling, to help determine the genetic origins, relative and seasonal abundance, distribution and utilization of estuarine and marine habitat by Gulf sturgeon within Charlotte Harbor estuary and Charlotte Harbor Entrance Channel, and shall report to NOAA Fisheries biannually on the progress and final results of said study.

10. *Relocation Trawling - Guidelines*: Within six months of the issuance of this Opinion, the COE's Gulf of Mexico Districts, in coordination with COE's SAD, shall develop relocation trawling guidelines to ensure safe handling and standardized data gathering techniques for sea turtles and Gulf sturgeon by COE contractors, and forward copies to NOAA Fisheries' Protected Resources Division.

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.

11.0 Reinitiation of Consultation

Requirements for Reinitiation of Consultation: Reinitiation of formal consultation is required if (a) the amount or extent of taking specified in the incidental take statement is exceeded, (b) new information reveals effects of the action that may affect listed species or critical habitat when designated in a manner or

12.0 Appendices

Appendix I.

Summary of Takes by Hopper Dredges in the COE Galveston District Since the 1995 RBO.

TABLE 1

MAINTENANCE DREDGING TURTLE TAKES BY FISCAL YEAR

Date Taken	Kemp's ridley	Loggerhead	Green	Hawksbill
Fiscal Year 1995				
Feb 19, 1995			1	
Feb 22, 1995			1	
Feb 26, 1995	1			
Aug 5, 1995	1			
Aug 31, 1995	1			
Sep 4, 1995	1			
Sep 16, 1995		1		
TOTAL FY 95	4	1	2	0
Fiscal Year 1996				
Oct 9, 1995		1		
Jun 28, 1996		1		
Jul 11, 1996		1		
Jul 13, 1996		1		
Jul 22, 1996		1		
TOTAL FY 96	0	5	0	0
Fiscal Year 1997				
Oct 13, 1996		1		
Mar 26, 1997	1			
Apr 29, 1997	1			
Jun 13, 1997		1		
TOTAL FY 97	2	2	0	0
Fiscal Year 1998				
TOTAL FY 98	0	0	0	0

Fiscal Year 1999				
Oct 29, 1998		1		
Feb 18, 1999			1	
Mar 2, 1999			1	
Jun 18, 1999		1		
Jun 19, 1999		1		
Jun 30, 1999		1		
TOTAL FY 99	0	4	2	0

Fiscal Year 2000				
Aug 10, 2000		1		
Aug 15, 2000		1		
TOTAL FY 00	0	2	0	0

Fiscal Year 2001				
TOTAL FY 01	0	0	0	0

Fiscal Year 2002				
Mar 18, 2002			1	
Mar 19, 2002			2	
Mar 20, 2002			1	
Aug 11, 2002		1		
TOTAL FY 02	0	1	4	0

TOTAL	6	15	8	0

TABLE 2

NEW-WORK DREDGING TURTLE TAKES BY FISCAL YEAR

Date Taken	Kemp's ridley	Loggerhead	Green	Hawksbill
Fiscal Year 1999				
Jan 4, 1999	1			

TABLE 2

NEW-WORK DREDGING TURTLE TAKES BY FISCAL YEAR

Date Taken	Kemp's ridley	Loggerhead	Green	Hawksbill
Sep 29, 1999			1	
TOTAL FY 99	1	0	1	0
Fiscal Year 2000				
TOTAL FY 00	0	0	0	0
TOTAL	1	0	1	0

TABLE 3

TURTLE TAKES BY PROJECT

Date Taken	Kemp's ridley	Loggerhead	Green	Hawksbill
Brazos Island Harbor				
Feb 19, 1995			1	
Feb 22, 1995			1	
Feb 26, 1995	1			
Apr 29, 1997	1			
Jun 13, 1997		1		
Feb 18, 1999			1	
Mar 2, 1999			1	
Mar 18, 2002			1	
Mar 19, 2002			1	
TOTAL	2	1	6	0
Corpus Christi Ship Channel				
Sep 16, 1995		1		
Jun 18, 1999		1		
Jun 19, 1999		1		
Jun 30, 1999		1		
TOTAL	0	4	0	0

TABLE 3

TURTLE TAKES BY PROJECT

Date Taken	Kemp's ridley	Loggerhead	Green	Hawksbill
Freeport Harbor				
Oct 9, 1995		1		
Jun 28, 1996		1		
Jul 11, 1996		1		
Jul 13, 1996		1		
Jul 22, 1996		1		
Oct 29, 1998		1		
Aug 10, 2000		1		
Aug 15, 2000		1		
TOTAL	0	8	0	0

Galveston Harbor and Channel /Houston-Galveston Navigation Channels				
Aug 15, 1995	1			
Aug 31, 1995	1			
Sep 4, 1995	1			
Jan 4, 1999	1			
Sep 29, 1999			1	
TOTAL	4	0	1	0

Matagorda Ship Channel				
Oct 13, 1996		1		
TOTAL	0	1	0	0

Sabine – Neches Waterway				
Mar 26, 1997	1			
Aug 11, 2002		1		
TOTAL	1	1	0	0

Port Mansfield Channel

TABLE 3

TURTLE TAKES BY PROJECT

Date Taken	Kemp's ridley	Loggerhead	Green	Hawksbill
Mar 19, 2002			1	
Mar 20, 2002			1	
TOTAL	0	0	2	0

Appendix II:

PROTOCOL FOR COLLECTING TISSUE FROM DEAD 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% DMSO *(SEE BELOW)
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 whirlpak 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.

*The 20% 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 – DEAD turtles

latex gloves
single-use scalpel blades (Fisher Scientific 1-800-766-7000, cat. # 08-927-5A)
plastic screw-cap vial containing saturated NaCl with 20% 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:

PROTOCOL FOR COLLECTING TISSUE FROM LIVE TURTLES FOR GENETIC ANALYSIS

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% DMSO *(SEE BELOW)
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 whirlpak 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% 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 – LIVE turtles

- latex gloves
  alcohol swabs
  Betadine/iodine swabs
  4-6 mm biopsy punch – sterile, disposable (Moore Medical Supply 1-800-678-8678, part #0052442)
  plastic screw-cap vial containing saturated NaCl with 20% DMSO, wrapped in parafilm
  wooden skewer
  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 if parafilm to wrap the cap of the vial
  whirl-pak to return/store sample vial

Appendix IV: 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 guidelines are adapted from 50 CFR § 223.206(d)(1). Failure to follow these procedures is therefore a punishable offense under the Endangered Species Act.

13.0 BIBLIOGRAPHY

1. Literature Cited - Turtle Species Accounts
2. Literature Cited - Gulf Sturgeon Species Account
3. General References and Other Literature Cited

1. Literature Cited - Turtle Species Accounts

Audubon, J.J. 1926. The Turtlers. Pp. 194-202 In: Delineations of American Scenery and Character, G.A Baker and Co., N.Y.

Balazs, G.H. 1982. Growth rates of immature green turtles in the Hawaiian Archipelago, p. 117 - 125. *In* K.A. Bjorndal (ed.), Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C.

Balazs, G.H. 1983. Recovery records of adult green turtles observed or originally tagged at French Frigate Shoals, northwestern Hawaiian Islands. NOAA Tech. Memo. NMFS-SWFC-36.

Balazs, G.H. 1999. Factors to consider in the tagging of sea turtles. In: Research and Management Techniques for the Conservation of Sea Turtles, by K.L. Eckert, K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly (editors). IUCN/SSC Marine Turtle Specialist Group Publication No. 4, 1999.

Bass, A.L., S.P. Epperly, J. Braun, D.W. Owens, and R.M. Patterson. 1998. Natal origin and sex ratios of foraging sea turtles in the Pamlico-Albemarle Estuarine Complex. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SEFSC-415: 137-138.

Bjorndal, K.A., J.A. Wetherall, A.B. Bolten, and J.A. Mortimer. 1999. Twenty-six years of green turtle nesting at Tortuguero, Costa Rica: an encouraging trend. Conservation Biology 13: 126-134.

Brongersma, L. 1972. European Atlantic Turtles. Zool. Verhand. Leiden, 121: 318 pp.

Caldwell, D.K. and A. Carr. 1957. Status of the sea turtle fishery in Florida. Transactions of the 22nd North American Wildlife Conference, 457-463.

Carr, A.F., M.H. Carr, and A.B. Meylan. 1978. The ecology and migrations of sea turtles, 7. The west Caribbean green turtle colony. Bulletin of the American Museum of Natural History 162: 1-46.

Carr, A. 1984. So Excellent a Fishe. Charles Scribner's Sons, N.Y

Díez, C.E. 2000. Personal communication to Blair Witherington, FMRI.

Dodd, C.K. 1981. Nesting of the green turtle, *Chelonia mydas* (L.), in Florida: historic review and present trends. Brimleyana 7: 39-54.

Dodd, C.K. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service, Biological Report 88 (14).

Doughty, R.W. 1984. Sea turtles in Texas: a forgotten commerce. Southwestern Historical Quarterly 88: 43-70.

Dutton, P.H., B.W. Bowen, D.W. Owens, A. Barragán, and S.K. Davis. 1999. Global phylogeography of the leatherback turtles (*Dermochelys coriacea*). J. Zool. Lond 248:397-409.

Eckert, S.A. and K.L. Eckert, P. Ponganis, and G.L. Kooyman. 1989. Diving and foraging behavior of leatherback sea turtles (*Dermochelys coriacea*). Can. J. Zool. 67:2834-2840.

Eckert, K. L. 1995. Hawksbill sea turtle (*Eretmochelys imbricata*). National Marine Fisheries Service and U.S. Fish and Wildlife Service Status Reviews for Sea Turtles Listed under the Endangered Species Act of 1973. Silver Spring, Maryland: National Marine Fisheries Service, pp. 76-108.

Ehrhart, L.M. 1983. Marine turtles of the Indian River Lagoon System. Florida Sci. 46: 337-346.

Ehrhart, L.M. 1989. Status report of the loggerhead turtle. In Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham (eds.). Proceedings of the 2nd Western Atlantic Turtle Symposium. NOAA Technical Memorandum NMFS-SEFC-226: 122-139.

Ehrhart, L.M. and B.E. Witherington. 1992. Green turtle. In P. E. Moler (ed.). Rare and Endangered Biota of Florida, Volume III. Amphibians and Reptiles. University Presses of Florida: 90-94.

Epperly, S.P., J. Braun, and A.J. Chester. 1995b. Aerial surveys for sea turtles in North Carolina inshore waters. Fishery Bulletin 93: 254-261.

Ernst, L.H. and R.W. Barbour. 1972. Turtles of the United States. Univ. Kentucky Press, Lexington, Ky.

Florida Marine Research Institute, Florida Dept. of Environmental Protection. 2001. Florida statewide nesting beach survey data. Florida Department of Environmental Protection. Unpublished data.

FPL (Florida Power & Light Co.) St. Lucie Plant. 2000. Annual environmental operating report 1999. Juno Beach, Fla.

Frazer, N.B. and L.M. Ehrhart. 1985. Preliminary growth models for green, *Chelonia mydas*, and loggerhead, *Caretta caretta*, turtles in the wild. Copeia 1985: 73-79.

Frazer, N.B., C.J. Limpus, and J.L. Greene. 1994. Growth and age at maturity of Queensland loggerheads. U.S. Dep. of Commer. NOAA Tech. Mem. NMFS-SEFSC-351:42-45.

Garduño-Andrade, M., Guzmán, V., Miranda, E., Briseno-Duenas, R., and Abreu, A. 1999. Increases in hawksbill turtle (*Eretmochelys imbricata)* nestings in the Yucatán Peninsula, Mexico (1977-1996): data in support of successful conservation? Chelonian Conservation and Biology 3(2):286-295.

Groombridge, B. 1982. The IUCN Amphibia - Reptilia Red Data Book. Part 1. Testudines, Crocodylia, Rhynchocephalia. Int. Union Conserv. Nature and Nat. Res., 426 pp.

Guseman, J.L. and L.M. Ehrhart. 1992. Ecological geography of Western Atlantic loggerheads and green turtles: evidence from remote tag recoveries. In M. Salmon and J. Wyneken (compilers). Proceedings of the 11th Annual Workshop on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS. NMFS-SEFC-302: 50.

Henwood, T.A. and L.H. Ogren. 1987. Distribution and migrations of immature Kemp's ridley turtles (*Lepidochelys kempii*) and green turtles (*Chelonia mydas*) off Florida, Georgia, and South Carolina. Northeast Gulf Science, 9(2): 153-160.

Herbst, L.H. 1994. Fibropapillomatosis in marine turtles. Annual Review of Fish Diseases 4: 389-425.

Hildebrand, H. 1963. Hallazgo del area de anidación de la tortuga "lora" *Lepidochelys kempii* (Garman), en la costa occidental del Golfo de México (Rept., Chel.). Ciencia Mex., 22(a): 105-112

Hildebrand, H. 1982. A historical review of the status of sea turtle populations in the Western Gulf of Mexico. In K.A. Bjorndal (ed.). Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C. 447-453.

Hirth, H.F. 1997. Synopsis of the biological data on the green turtle *Chelonia mydas* (Linnaeus 1758). Biological Report 97(1), Fish and Wildlife Service, U.S. Dept of the Interior. 120 pp.

Hirth, H. 1980. Some aspects of the nesting behavior and reproductive biology of sea turtles. American Zoologist 20:507-523.

Jacobson, E.R. 1990. An update on green turtle fibropapilloma. Marine Turtle Newsletter 49: 7-8.

Jacobson, E.R., S.B. Simpson, Jr., and J.P. Sundberg. 1991. Fibropapillomas in green turtles. In G.H. Balazs, and S.G. Pooley (eds.). Research Plan for Marine Turtle Fibropapilloma, NOAA-TM-NMFS-SWFSC-156: 99-100.

Johnson, S.A., and L.M. Ehrhart. 1994. Nest-site fidelity of the Florida green turtle. In B.A. Schroeder and B.E. Witherington (compilers). Proceedings of the 13th Annual Symposium on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-341: 83.

Keinath, J.A. 1993. Movements and behavior of wild and head-started sea turtles. Ph.D. Dissertation. College of William and Mary, Gloucester Point, Va., 206 pp.

Lagueux, C.J. 1998. Demography of marine turtles harvested by Miskito Indians of Atlantic Nicaragua. In R. Byles and Y. Fernández (compilers). Proceedings of the 16th Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-412: 90.

Leon, Y.M. and C.E. Diez, 2000. Ecology and population biology of hawksbill turtles at a Caribbean feeding ground. Pp. 32-33 *in* Proceedings of the 18th International Sea Turtle Symposium, Abreu-Grobois, F.A., Briseno-Duenas, R. ,Marquez, R., and Sarti, L., Compilers. NOAA Technical Memorandum NMFS-SEFSC-436.

Lutcavage, M. and J.A. Musick. 1985. Aspects of the biology of sea turtles in Virginia. Copeia 1985(2): 449-456.

MacKay, A.L. and J.L. Rebholz. 1996. Sea turtle activity survey on St. Croix, U.S. Virgin Islands (1992-1994). In J.A. Keinath, D.E. Barnard, J.A. Musick, and B.A. Bell (Compilers). Proceedings of the 15th Annual Symposium on Sea Turtle Biology and Conservation. NOAA Tech. Memo. NMFS-SEFSC-387: 178-181.

Magnuson, J.J., K.A. Bjorndal, W.D. DuPaul, G.L. Graham, D.W. Owens, P.C.H. Pritchard, J.I. Richardson, G.E. Saul, and C.W. West. 1990. Decline of the sea turtles: causes and prevention National Academy Press, Washington, D.C. 274 pp.

Mayor, P., B. Phillips, and Z. Hillis-Starr. 1998. Results of stomach content analysis on the juvenile hawksbill turtles of Buck Island Reef National Monument, U.S.V.I. Pp. 230-232 *in* Proceedings of the 17th Annual Sea Turtle Symposium, S. Epperly and J. Braun, Compilers. NOAA Tech. Memo. NMFS-SEFSC-415.

Meylan, A.B. 1988. Spongivory in hawksbill turtles: a diet of glass. Science 239(393-395).

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the State of Florida 1979-1992. Florida Marine Research Publications 52: 1-51.

Meylan, A.B., and M. Donnelly. 1999. Status justification for listing the hawksbill turtle (*Eretmochelys imbricata* as critically endangered on the 1996 IUCN Red List of Threatened Animals. Chelonian Conservation and Biology 3(2): 200-204.

Meylan, A.B. 1999a. The status of the hawksbill turtle (*Eretmochelys imbricata*) in the Caribbean. Region. Chelonian Conservation and Biology 3(2): 177-184.

Meylan, A.B. 1999b. International movements of immature and adult hawksbill turtles (*Eretmochelys imbricata*) in the Caribbean region. Chelonian Conservation and Biology 3(2): 189-194.

Meylan, A.B., in prep. The hawksbill turtle (*Eretmochelys imbricata*). *In* Meylan, P. A,. and G. L. Heinrich, eds. The Biology and Conservation of Florida Turtles. Chelonian Research Monographs.

Morreale, S.J. and E.A. Standora. 1999. Vying for the same resources: potential conflict along migratory corridors. U.S. Dep. Commer. NOAA Tech. Mem. NMFS-SEFSC-415: 69.

Murphy, T.M. and S.R. Hopkins. 1984. Aerial and ground surveys of marine turtle nesting beaches in the Southeast Region. Unpublished report prepared for the National Marine Fisheries Service.

Nietschmann, B. 1982. The cultural context of sea turtle subsistence hunting in the Caribbean and problems caused by commercial exploitation. In K.A. Bjorndal (ed.). Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C. 439-445.

NMFS Southeast Fisheries Science Center. 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. U.S. Department of Commerce, National Marine Fisheries Service, Miami, Fla., SEFSC Contribution PRD-00/01-08; Parts I-III and Appendices I-V1.

NMFS and USFWS. 1991a. Recovery Plan for U.S. Population of Atlantic Green Turtle. National Marine Fisheries Service, Washington, D.C.

NMFS and USFWS. 1991b. Recovery Plan for U.S. Population of Loggerhead Turtle. National Marine Fisheries Service, Washington, D.C.

NMFS and USFWS. 1992. Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C.

NMFS and USFWS. 1993. Recovery Plan for Hawksbill Turtles in the U.S. Caribbean, Atlantic Ocean, and Gulf of Mexico. National Marine Fisheries Service, St. Petersburg, Fla.

NMFS and USFWS. 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. National Marine Fisheries Service, Silver Spring, Md.

Ogren, L.H. 1989. Distribution of juvenile and sub-adult Kemp's ridley sea turtle: Preliminary results from 1984-1987 surveys, pp. 116-123 in: Caillouet, C.W. and A.M. Landry (eds), First Intl. Symp. on Kemp's Ridley Sea Turtle Biol, Conserv. and Management. Texas A&M Univ.Galveston, Tex., Oct. 1-4, 1985, TAMU-SG-89-105.

Parsons, J.J. 1972. The hawksbill turtle and the tortoise shell trade. In: Études de géographie tropicale offertes a Pierre Gourou. Paris: Mouton, pp. 45-60.

Pritchard, P.C.H. 1969. Sea turtles of the Guianas. Bull. Fla. State Mus. 13(2): 1-139.

Renaud, M.L. 1995. Movements and submergence patterns of Kemp's ridley turtles (*Lepidochelys kempii*). Journal of Herpetology 29: 370-374.

Richardson, J.I., Bell, R. and Richardson, T.H. 1999. Population ecology and demographic implications drawn from an 11-year study of nesting hawksbill turtles, *Eretmochelys imbricata*, at Jumby Bay, Long Island, Antigua, West Indies. Chelonian Conservation and Biology 3(2): 244-250.

Ross, J.P. 1979. Historical decline of loggerhead, ridley, and leatherback sea turtles, pp. 189-195. In: Bjorndal, K.A. (editor), Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C.

Schmid, J.R. and W.N. Witzell. 1997. Age and growth of wild Kemp's ridley turtles (*Lepidochelys kempii*): cumulative results of tagging studies in Florida. Chelonian Conserv. Biol. 2: 532 - 537.

Schroeder, B.A., and A.M. Foley. 1995. Population studies of marine turtles in Florida Bay. In J. I. Richardson and T.H. Richardson (compilers). Proceedings of the Twelfth Annual Workshop on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-361: 117.

Schroeder, B.A., A.M. Foley, B.E. Witherington, and A.E. Mosier. 1998. Ecology of marine turtles in Florida Bay: Population structure, distribution, and occurrence of fibropapilloma. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SEFSC-415: 265-267.

Schultz, J.P. 1975. Sea turtles nesting in Surinam. Zoologische Verhandelingen (Leiden), Number 143: 172 pp.

Shaver, D.J. 1991. Feeding ecology of wild and head-started Kemp's ridley sea turtles in south Texas waters. Journal of Herpetology. Vol. 23. 1991.

Shaver, D.J. 1994. Relative abundance, temporal patterns, and growth of sea turtles at the Mansfield Channel, Texas. Journal of Herpetology 28: 491-497.

Shoop, C.R. and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs. 6: 43-67.

Smith, G.M. and C.W. Coates. 1938. Fibro-epithelial growths of the skin in large marine turtles, *Chelonia mydas* (Linnaeus). Zoologica 24: 93-98.

Spotila, J.R., A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: are leatherback turtles going extinct? Chel. Conserv. Biol. 2(2): 209-222.

Spotila, J.R., R.D. Reina, A.C. Steyermark, P.T. Plotkin and F.V. Paladino. 2000. Pacific leatherback turtles face extinction. Nature 405: 529-530.

TEWG. 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii)* and loggerhead (*Caretta caretta*) sea turtle populations in the western North Atlantic. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SEFSC-409, 96 pp.

TEWG. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. U.S. Dep. Commer. NOAA Tech. Mem. NMFS-SEFSC-444, 115 pp.

USFWS and NMFS. 1992. Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). National Marine Fisheries Service, St. Petersburg, Fla.

van Dam, R. and C. Diez, 1997. Predation by hawksbill turtles on sponges at Mona Island, Puerto Rico. Pp. 1421-1426, Proc. 8th International Coral Reef Symposium, v. 2.

van Dam, R. and C. Diez. 1998. Home range of immature hawksbill turtles (*Eretmochelys imbricata*) at two Caribbean islands. Journal of Experimental Marine Biology and Ecology, 220(1):15-24.

Wershoven, J.L. and R.W. Wershoven. 1992. Juvenile green turtles in their nearshore habitat of Broward County, Florida: a five-year review. In M. Salmon and J. Wyneken (compilers). Proceedings of the 11th Annual Workshop on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS. NMFS-SEFC-302: 121-123.

Witherington, B.E., and L.M. Ehrhart. 1989. Status and reproductive characteristics of green turtles (*Chelonia mydas*) nesting in Florida. In L. Ogren, F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham (eds.). Proceedings of the 2nd Western Atlantic Turtle Symposium, NOAA Technical Memorandum NMFS-SEFC-226: 351-352.

Zug, G.R.. and J.F. Parham. 1996. Age and growth in leatherback turtles, *Dermochelys coriacea* (Testudines: Dermochelyidae): a skeletochronological analysis. Chel. Conserv. Biol. 2(2): 244-249.

Zwinenberg. A.J. 1977. Kemp's ridley, *Lepidochelys kempii* (Garman, 1880), undoubtedly the most endangered marine turtle today (with notes on the current status of *Lepidochelys olivacea*). Bulletin of the Maryland Herpetological Society, 13(3): 170-192.

2. Literature Cited - Gulf Sturgeon Species Account:

Barkuloo, J. 1988. Report on the conservation status of the Gulf of Mexico sturgeon, *Acipenser oxyrhynchus desotoi.* U.S. Fish and Wildlife Service, Panama City, Florida.

Bateman, D.H. and M.S. Brim. 1994. Environmental contaminants in Gulf sturgeon of northwest Florida, 1985-1991. U.S. Fish and Wildlife Service. Pub. No. PCFO-EC 94-09. Panama City, Florida. 23 pp. with appendices.

Carr, A. 1983. All the way down upon the Suwannee River. Audubon Magazine 85(2):78-101

Chapman, F.A., S.F. O'Keefe, and D.E. Campton. 1993. Establishment of parameters critical for the culture and commercialization of Gulf of Mexico sturgeon, *Acipenser oxyrhynchus desotoi.* Final Report, NOAA, St. Petersburg, Florida.

Dadswell, M.J. 1979. Biology and population characteristics of the shortnose sturgeon, *Acipenser brevirostrum* LeSeueur 1818 (Osteichthyes: Acipenseridae), in the St. John River estuary, New Brunswick, Canada. Canadian Journal of Zoology 57:2186-2210.

Fraser, T.H. 1984. New record of *Acipenser oxyrhynchus* in Charlotte Harbor, Florida. Florida Scientist 47(1):78-79.

1991. Endangered and threatened wildlife and plants; determination of threatened status for the Gulf sturgeon. Federal Register 56(189): 49653-49658.

1999. U.S. Fish and Wildlife Service. Draft biological opinion on the effects of the Mobile, Alabama, Harbor Navigation Project (Hurricane Recovery Plan) on the threatened Gulf sturgeon, *Acipenser oxyrinchus desotoi.* 28 pp. Feb. 26.

FWS & GSMFC. 1995. U.S. Fish and Wildlife Service and Gulf States Marine Fisheries Commission. Gulf sturgeon recovery plan. Atlanta, Georgia. 170 pp.

Gilbert, C. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic Bight)--Atlantic and shortnose sturgeons. U.S. Fish and Wildlife Service, Biological Report 82(11.12). U.S. Army Corps of Engineers TR EL-82-4. 28 pp.

Hollowell, J. 1980. Information report Gulf of Mexico sturgeon, *Acipenser oxyrhynchus desotoi* (Vladykov). U.S. Fish and Wildlife Service. Unpublished report.

Huff, J.A. 1975. Life history of the Gulf of Mexico sturgeon, *Acipenser oxyrhynchus desotoi,* in the Suwannee River, Florida. Marine Resources Pub. No. 16. 32 pp.

Mason, W.T., Jr., and J.P. Clugston. 1993. Foods of the Gulf sturgeon *Acipenser oxyrhynchus desotoi* in the Suwannee River, Florida. Transactions of the American Fisheries Society 122:378-385.

Odenkirk, J.S. 1989. Movements of Gulf of Mexico sturgeon in the Apalachicola River, Florida. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies. 43:230-238.

Reynolds, C.R. 1993. Gulf sturgeon sightings, historic and recent–a summary of public responses. U.S. Fish and Wildlife Service. Panama City, Fla. 40pp.

Sulak, K.J. and J.P. Clugston. 1999. Recent advances in life history of Gulf of Mexico sturgeon *Acipenser oxyrinchus desotoi* in the Suwannee River, Florida, U.S.A.: a synopsis. J. Appl. Ichth. 15: 116 - 128.

Swift, C., R.W. Yerger, and P.R. Parrish. 1977. Distribution and natural history of the fresh and brackish water fishes of the Ochlockonee River, Florida and Georgia. Bull. Tall Timbers Res. Sta. No. 20. October. Pp. 18-19. Tallahassee, Florida.

White, D.H., C.A. Mitchell, H.D. Kennedy, A.J. Krynitsky, and M.A. Ribick. 1983. Elevated DDE and toxaphene residues in fishes and birds refelct local contamination in the lower Rio Grande Valley, Texas. The Southwestern Naturalist 28(3):325-333.

Wooley, C.M., P.A. Moon, and E.J. Crateau. 1982. A larval Gulf of Mexico sturgeon (*Acipenser oxyrhynchus desotoi*) from the Apalachicola River, Florida. Northeast Gulf Science 5(2):57-58.

Wooley, C.M. and E.J. Crateau. 1985. Movement, microhabitat, exploitation, and management of Gulf of Mexico sturgeon, Apalachicola River, Florida. North American Journal of Fisheries Management 5:590-605.

Ziewitz, J.W. and G.A. Carmody. 1998. Anadromous fish habitat in the Alabama-Coosa-Tallapoosa and Apalachicola-Chattahoochee-Flint River basins. U.S. Fish and Wildlife Service. Panama City, Florida. December.

3. General References and Other Literature Cited

Aguilar, R., J. Mas, and X. Pastor. 1995. Impact of Spanish swordfish longline fisheries on the loggerhead sea turtle *Caretta caretta* population in the western Mediterranean. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SEFSC-361:1-6.

Aguirre, A.A., Balazs, G., Zimmerman, B. and F.D. Galey. 1994. Organic contaminants and trace metals in the tissues of green turtles (*Chelonia mydas*) affected with fibropapillomas in the Hawaiian Islands. Marine Pollution Bulletin 28:109-114.

Anonymous. 1990. Sources of oil pollution in the oceans. Marine Conservation News 2(3):1-20, Autumn.

Applied Biology, Inc. 1993. Florida Power & Light Company, St. Lucie Unit 2 annual environmental operating report. AB-631. Prepared by Applied Biology, Inc. for Florida Power & Light Co. Juno Beach, Florida, pp. 71.

Babcock, H.L. 1937. The sea turtles of the Bermuda Islands, with a survey of the present state of the turtle fishing industry. Proc. Zool. Soc. Lond. 107: 595-601.

Bagley, D. and L. Ehrhart. 2000. Unpublished data.

Barlow, J. and P.J. Clapham. 1997. A new birth-interval approach to estimating demographic parameters of humpback whales. Ecology 78(2): 535-546.

Bass, A.L. 1999. Genetic analysis of juvenile loggerheads captured at the St. Lucie Power Plant.A report to National Marine Fisheries Service and Quantum Resources, Inc.

Bass, A.L., S-M. Chow, and B.W. Bowen. 1999. Final report for project titled: genetic identities of loggerhead turtles stranded in the Southeast United States. Unpublished report to NMFS, order number 40-AANF809090. Department of Fisheries and Aquatic Sciences, University of Florida, Gainesville, Fla., 11 pp.

Bass, A.L., S.P. Epperly, J. Braun, D.W. Owens, and R.M. Patterson. 1998. Natal origin and sex ratios of foraging sea turtles in the Pamlico-Albemarle Estuarine Complex. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SEFSC-415:137-138.

Bass, A. L., C. J. Lagueux, and B. W. Bowen. 1998. Mixed stock composition of the Miskitu Cays green turtle fishery based on mtDNA markers. In S. P. Epperly, and J. Braun (Compilers). Proceedings of the Seventeenth Annual Sea Turtle Symposium. NOAA Tech. Memo. NMFS-SEFSC-415:7.

Belardo E., R. Matos, and F. Ortiz. 2000. Annual Report, Sea Turtle Conservation Project on Vieques Island. Department of Natural and Environmental Resources, San Juan, Puerto Rico. Report to U.S. Naval Station Roosevelt Roads.

Belardo, E., R. Matos, and F. Ortiz. 1999. 1998 Annual Report, Sea Turtle Conservation Project on Vieques Island. Department of Natural and Environmental Resources, San Juan, Puerto Rico.. Report to U.S. Naval Station Roosevelt Roads.

Belardo, E., R. Matos, and F.J. Ortiz.. 1998. 1997 Annual Report, Sea Turtle Conservation Project on Vieques Island. Department of Natural and Environmental Resources, San Juan, Puerto Rico. Report to U.S. Naval Station Roosevelt Roads.

Belardo, E., R. Matos, and F.J. Sanez. 1997. 1996 Annual Report, Sea Turtle Conservation Project on Vieques Island. Department of Natural and Environmental Resources, Report to U.S. Naval Station Roosevelt Roads.

Belardo, E., R. Matos, and F.J. Ortiz. 1996. 1995 Annual Report, Sea Turtle Conservation Project on Vieques Island. Department of Natural and Environmental Resources, San Juan, Puerto Rico. Report to U.S. Naval Station Roosevelt Roads.

Belardo, E., R. Matos, and J.F. Sanez. 1995. 1994 Annual Report, Sea Turtle Conservation Project on Vieques Island. Department of Natural and Environmental Resources, San Juan, Puerto Rico. Report to U.S. Naval Station Roosevelt Roads.

Belardo, E., R. Matos, and G. Roman. 1994. 1993 Annual Report, Sea Turtle Conservation Project on Vieques Island. Department of Natural and Environmental Resources, San Juan, Puerto Rico. Report to U.S. Naval Station Roosevelt Roads.

Belardo, E., R. Matos, and G. Roman. 1993. 1992 Annual Report, Sea Turtle Conservation Project on Vieques Island, Final Draft. Department of Natural and Environmental Resources, San Juan, Puerto Rico. Report to U.S. Naval Station Roosevelt Roads.

Bellmund, S., M.T. Masnik, and G. Laroche. 1982. Assessment of the impacts of the St. Lucie Nuclear Plant on threatened or endangered species. U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation. Docket No. 50-398, pp 68.

Best, P.B. 1979. Social organization in sperm whales, *Physeter macrocephalus*. In: H.E. Winn and B.L. Olla (Eds.) Behavior of marine animals, volume 3: cetaceans, p.227-289. Plenum Press, N.Y.

Bishop, C.A., Brown, G.P., Brooks, R.J., Lean, D.R.S., and J.H. Carey. 1994. Organochlorine contaminant concentrations in eggs and their relationship to body size and clutch characteristics of the female common snapping turtle (*Chelydra serpentina*) in Lake Ontario, Canada. Archives of Environmental Contamination and Toxicology 27:82-87.

Bishop, C.A., Brooks, R.J., Carey, J.H., Ng, P., Norstrom, R.J. and D.R.S. Lean. 1991. The case for a cause-effect between environmental contamination and development in eggs of the common snapping turtle (*Chelydra serpentina*) from Ontario, Canada. Journal of Toxicology and Environmental Health 33:521-547.

Bjorndal, K.A., A.B. Bolten, and H.R. Martins. In press. Somatic growth model of juvenile loggerhead sea turtles: duration of the pelagic stage.

Bjorndal, K.A., Bolten, A.B., and C.J. Lagueux. 1994. Ingestion of marine debris by juvenile sea turtles in coastal Florida habitats. Marine Pollution Bulletin, Vol. 28, No. 3, 154-158.

Bjorndal, K.A., A.B. Bolten, J. Gordon, and J.A. Camiñas. 1994a. *Caretta caretta* (loggerhead) growth and pelagic movement. Herp. Rev. 25:23-24.

Bjorndal, K.A., A.B. Meylan, and B.J. Turner. 1983. Sea turtles nesting at Melbourne Beach, Florida. I. Size, growth and reproductive biology. Biological Conservation 26:65-77.

Blaylock, Robert A., J.W. Hain, L.J. Hansen, D.L. Palka, and G.T. Waring. 1995. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments. NOAA Technical Memorandum NMFS-SEFSC-363. July. 211 pp.

Bolten, A.B., K.A. Bjorndal, H.R. Martins, T. F Dellinger, M.J. Biscoito, S.E. Encalada, and B.W. Bowen. 1998. Trans-Atlantic developmental migrations of loggerhead sea turtles demonstrated by mtDNA sequence analysis. Ecological Applications 8:1-7.

Bolten, A.B., K.A. Bjorndal, and H.R. Martins. 1994. Life history model for the loggerhead sea turtle (*Caretta caretta*) populations in the Atlantic: Potential impacts of a longline fishery. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SWFC-201:48-55.

Bolten, A.B., H.R. Martins, K.A. Bjorndal, and J. Gordon. 1993. Size distribution of pelagic-stage loggerhead sea turtles (*Caretta caretta*) in the waters around the Azores and Madeira. Arquipelago 11A: 49-54.

Bolten, A.B. and K.A. Bjorndal. 1991. Effects of marine debris on juvenile, pelagic sea turtles. Interim Project Report to the National Marine Fisheries Service Marine Entanglement Research Program. 41 pp.

Bowen, B.W., J.C. Avise, J.I. Richardson, A.B. Meylan, D. Margaritoulis, and S.R. Hopkins-Murphy. 1993. Population structure of loggerhead turtles (*Caretta caretta*) in the northwestern Atlantic Ocean and Mediterranean. Sea. Conserv. Biol. 7:834-844.

Bowen, B.W. 1995. Tracking marine turtles with genetic markers. BioSci. 45:528-53.

Brown, C.A., J.A. Cramer, and A. Bertolino. 2000. Estimates of bycatch by the U.S. Atlantic pelagic longline fleet during 1993-1998. Proceedings of the Sixth National Stock Assessment Workshop, March 28-30, 2000. NOAA Tech. Memo. NMFS-NWFSC.

Brown, C. 2000. Fishery Biologist, NMFS-Pelagic Longline Observer Program. Personal communication to Terri Jordan, NMFS, Silver Spring, MD.

Burchfield, P. 1996a. Personal Communication. Gladys Porter Zoo, Brownsville, Texas.

Burchfield, P. 1996b. Report on the Mexico/United States of America Kemp's ridley sea turtle population restoration project at the Rancho Nuevo, Barra Del Tordo, Barra Ostionales, Tepehuajes, La Pesca and Altamira Camps, Tamaulipas, Mexico. U.S. Department of Commerce, National Marine Fisheries Service.

Byles, R.A. 1988. Behavior and ecology of sea turtles from Chesapeake Bay, Virginia. A dissertation presented to the faculty of the School of Marine Science, The College of William and Mary in Virginia, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Caldwell, D.K. and D.S. Erdman. 1969. Pacific ridley sea turtle, *Lepidochelys olivacea*, in Puerto Rico. Bull. So. Calif. Acad. Sci. 68: 112.

Cannon, A.C. and J.P. Flanagan. 1996. Trauma and treatment of Kemp's ridley sea turtlews caught on hook-and-line by recreational fishermen. Draft abstract submitted for the 18th Annual Sea Turtle Symposium, Hilton Head, SC. February.

Carocci, F. and J. Majkowski. 1998. Aatlas of tuna and billfish catches. CD-ROM version 1.0. FAO, Rome, Italy.

Carr, A. 1987. New perspectives on the pelagic stage of sea turtle development. Conserv. Biol. 1:103-121.

Carr, A.F. 1954. The passing of the fleet. A. I .B. S. Bull. 4(5):17-19.

Carr, A.F. 1952. Handbook of Turtles. Ithaca, New York: Cornell University Press.

Carr, A.F., M.H. Carr and A.B. Meylan. 1978. The ecology and migrations of sea turtles. 7. The western Caribbean green turtle colony. Bull. Amer. Mus. Nat. Hist. 162(1):1-46.

Carr, A.F. and L. Ogren. 1960. The ecology and migrations of sea turtles. 4. The green turtle in the Caribbean Sea. Bull. Amer. Mus. Nat. Hist. 131(1):1-48.

CeTAP. 1982. A characterization of marine mammals and turtles in the mid- and north-Atlantic areas of the U.S. outer continental shelf, Final Report. U.S. Dept. of Interior, Bureau of Land Management, Contract No. AA551-CT8-48, Washington, D.C. 538 pp.

Chevalier, J. and Girondot, M. 1998. Nesting dynamics of marine turtles in French Guiana during the 1997 nesting season. Bull. Soc. Herp. Fr., 85-86: 5-19.

Clapham, P.J. and J.G. Mead. 1999. *Megaptera novaeangliae*. Mammalian Species. No. 604. 9 pp.

Clark, C.W. 1995. Application of U.S. Navy underwater hydrophone arrays for scientific research on whales. Rep. IWC 45: 210-212.

Clarke, M.R. 1980. Cephalapoda in the diet of sperm whales of the Southern Hemisphere and their bearing on sperm whale biology. Discovery Rep. 37:1-324.

Clarke, M.R. 1962. Stomach contents of a sperm whale caught off Madeira in 1959. Norsk Hvalfangst-tidende 51(5):173-191.

Coe, J.M., Rogers, D.B., Alexander, D.E., Laist, D.W. 1996. Marine Debris Sources, Impacts, and Solutions. National Marine Fisheries Service, ISBN 0-387-94759-0.

Cox, B.A. and Mauermann, R. G. Incidental Catch and Disposition of Sea Turtles by the Brownsville-Port Isabel Gulf Shrimp Fleet. 5 pp.

Cramer, J. and H. Adams. 2000. Large pelagic logbook newsletter: 1998. NOAA Tech. Memo. NMFS-SEFSC-433. 25 pp.

Crouse, D.T. 1999. The consequences of delayed maturity in a human-dominated world. American Fisheries Society Symposium. 23:195-202.

Crouse, D.T., L.B. Crowder, and H. Caswell. 1987. A stage-based population model for loggerhead sea turtles and implications for conservation. Ecol. 68:1412-1423.

Crowder, L.B., D.T. Crouse, S.S. Heppell, and T.H. Martin. 1994. Predicting the impact of turtle excluder devices on loggerhead sea turtle populations. Ecol. Applic. 4:437-445.

Dahlen, M.K., R. Bell, J.I. Richardson, and T.H. Richardson. 2000. Beyond D-0004: Thirty-four years of loggerhead (*Caretta caretta*) research on Little Cumberland Island, Georgia, 1964-1997. Proceedings of the Eighteenth International Sea Turtle Symposium. U.S. Dept. of Commerce, NOAA Technical Memorandum NMFS-SEFSC-436, pp. 60-62.

Dahlgren. 2000. Noise Blast Test Results Aboard USS Cole. Report from Dahlgren Division, Naval Surface Warfare Center to Commander-in Chief, U.S. Atlantic Fleet (N3). 18 July.

Davis, R. 2000. Personal Communication to Kathy Wang, NMFS St. Petersburg, Fla.

Davenport, J. and J. Wrench. 1990. Metal levels in a leatherback turtle. Marine Pollution

Bulletin 21:40-41

Dellinger, T. and H. Encarnacao. 2000. Accidental capture of sea turtles by the fishing fleet based at Madeira Island, Portugal. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-443:218.

Department of Defense. 1999. The National Security Need for Vieques. July.

Department of the Navy. 1998. Shock Testing the SEAWOLF submarine. Final Environmental Impact Statement. Department of the Navy with cooperation from the National Marine Fisheries Service.

Dickerson, D.D. and D.A. Nelson. 1989. Recent results on hatchling orientation responses to light wavelengths and intensities. Pages 41-43 *in* Eckert, S.A., K.L. Eckert, and T.H. Richardson (compilers). Proceedings of the 9th Annual Workshop on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFSC-232.

Dickerson, D.D. and J.E. Clausner. 2003. Draft: Summary of Sea Turtle/Dredging Issues and Recommended Action Tasks Generated by the Improved Draghead Design Meeting, September 4, 2003, Atlanta, Georgia. U.S. Army Corps of Engineers, Engineering Research and Development Center, Vicksburg, Mississippi. 13pp.

Díez, C.E. 2000. Personal communication to Blair Witherington, FMRI.

Díez, C.E. and R.P. van Dam. 2000. Research Report for 1999 with summary of findings 1995 - 1999. Mona and Monito Island Hawksbill Turtle Research Project. Puerto Rico Department of Natural Resources, San Juan, PR (Díez)/Scripps Institute of Oceanography, La Jolla, CA (van Dam)

Doughty, R.W. Sea turtles in Texas: A forgotten commerce. Southwestern Historical Quarterly:43-70.

Eckert, K.L. 1993. Draft Status Review of Sea Turtles Listed Under the Endangered Species Act of 1973. Leatherback Sea Turtle *Dermochelys coriacea*. Prepared for NMFS, Silver Spring, MD.

Ecology and Environment. 1980. Environmental impact statement for the continued use of the Atlantic Fleet Weapons Training Facility, Inner Range (Vieques),Puerto Rico.

Ehrhart, L.M. 1983. Marine turtles of the Indian River lagoon system. Florida Sci. 46(3/4):337-346.

Ehrhart, L.M. 1979. A survey of marine turtle nesting at Kennedy Space Center, Cape Canaveral Air Force Station, North Brevard County, Florida, 1-122. Unpublished report to Division of Marine Resources, St. Petersburg, Florida, Fla. Dept. Nat. Res.

Epperly, S.P. and Braun-McNeill. 2002. The Use of AVHRR Imagery and the Management of Sea Turtle Interactions in the Mid Atlantic Bight. NMFS Southeast Fisheries Science Center. Unpublished.

Ernst, L.H. and R.W. Barbour. 1972. Turtles of the United States. Univ. Kentucky Press, Lexington Kentucky.

Epperly, S.A. 1996. Personal Communication. NMFS Beaufort Laboratory, North Carolina.

Epperly, S.P., J. Braun, and A. Veishlow. 1995. Sea turtles in North Carolina waters. Conserv. Biol. 9:384-394.

Epperly, S.P., J. Braun, A. J. Chester, F.A. Cross, J. . Merriner, and P.A. Tester. 1995. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. Bull. Mar. Sci. 56(2):519-540.

Epperly, S.A., Braun, J., Chester, A.J., Cross, F.A., Merriner, J.V., and P.A. Tester. 1994. Beach strandings as an indicator of at-sea mortality of sea turtles. Submitted to Fishery Bulletin. January 10, 1994.

Erdman, D.S., J. Harms, and M.M. Flores. 1973. Cetacean records from the northeastern Caribbean region. Cetology 17. 14 pp.

Expert Working Group (Byles, R, C. Caillouet, D. Crouse, L. Crowder, S. Epperly, W. Gabriel, B. Gallaway, M. Harris, T. Henwood, S. Heppell, R. Marquez-M, S. Murphy, W. Teas, N. Thompson, and B. Witherington) 1996. Kemp's ridley sea turtle (*Lepidochelys kempii*) status report. Submitted to NMFS June 28, 1996.

Expert Working Group (Byles, R, C. Caillouet, D. Crouse, L. Crowder, S. Epperly, W. Gabriel, B. Gallaway, M. Harris, T. Henwood, S. Heppell, R. Marquez-M, S. Murphy, W. Teas, N. Thompson, and B. Witherington) 1996. Status of the loggerhead turtle population (*Caretta caretta*) in the Western North Atlantic. Submitted to NMFS July 1, 1996.

Florida Marine Research Institute. Unpublished Data. Index Nesting Beach Survey Database. St. Petersburg, Fla.

Florida Power & Light Co. 1985. Sea turtle intake entrapment studies. Special Document 4/9/85.

Florida Power & Light Co. 2000. Physical and ecological factors influencing sea turtle entrainment at the St. Lucie Nuclear Plant: 1976-1998.

Florida Power & Light Co. 2000. M. Bressette. Unpublished data.

Foley, A. 2000. Florida Marine Research Institute, St. Petersburg, Fla. Personal communication.

Francisco, A.M., A.L. Bass, K.A. Bjorndal, A.B. Bolten, R. Reardon, M. Lamont, Y. Anderson, J. Foote, and B.W. Bowen. 2000. Stock structure and nesting site fidelity in Florida loggerhead turtles (*Caretta caretta*) resolved with mtDNA sequences. Unpublished Manuscript. Department of Fisheries and Aquatic Sciences, University of Florida, Gainesville, 23pp.

Frazer, N.B. 1992. Sea turtle conservation and halfway technology. Cons. Biol. 6:179-184.

Frazer, N.B., C.J. Limpus, and J.L. Greene. 1994. Gorwth and age at maturity of Queensland loggerheads. U.S. Dep. of Commer. NOAA Tech. Mem. NMFS-SEFSC-351: 42-45.

Frazer, N.B. and L.M. Ehrhart. 1985. Preliminary growth models for green, *Chelonia mydas*, and loggerhead, *Caretta caretta*, turtles in the wild. Copeia 1985:73-79.

Fuller, D.A. and Tappan, A.M. The Occurrence of Sea Turtles in Louisiana Coastal Waters. Coastal Fisheries Institute, Center for Wetland Resources, Louisiana State University. 1986 Sep. 46 pages.

Fulton, J. 1998. Personal Communication. U.S. Department of the Interior, Fish and Wildlife Service, Bon Secour National Wildlife Refuge, AL.

Gambell, R. 1985. Sei whale -- *Balaenoptera borealis*. In: Ridgway, S.H. and R. Harrison, eds. Handbook of marine mammals. Vol. 3: The sirenians and baleen whales. London: Academic Press. Pp. 155-170.

Geo-Marine, Inc. 1996. Land Use Management Plan for U.S. Naval Facilities Vieques, Puerto Rico

Gitschlag, G. 2001. NMFS Laboratory, Galveston, TX. Personal communication (July 24 e-mail) to Eric Hawk, NMFS, St. Petersburg, Fla.

Gitschlag, G. 1998. NMFS Laboratory, Galveston, TX. Personal communication to Kathy Wang, NMFS, St. Petersburg, Fla.

Gitschlag, G., and B.A. Herczeg. 1994. Sea Turtle Observations at Explosive Removals of Energy Structures. Marine Fisheries Review 56(2) pp 1-8.

Hansen, L.J., D.D. Mullin, T.A. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. Pages 55-132 in R.W.

Hain, J.H.W., M.J. Ratnaswamy, R.D. Kenney, and H.E. Winn. 1992. The fin whale in waters of the northeastern U.S. continental shelf. Rep. IWC 42: 653-669.

Harmer, K.B.E. 1923. Cervical vertebrae of a gigantic blue whale from Panama. Proceed. Zool. Soc. London 1923: 1085-1089.

Hastings, M. 2000. Analyses of sound levels by Mark 45 ship-to-shore guns. Unpublished report, 8 pp. Provided by Richard Copaken, Esq., to NMFS SERO.

Henwood, T.A., W. Stuntz, and N. Thompson. 1992. Evaluation of U.S. Turtle Protective Measures under existing TED regulations, including estimates of shrimp trawler related mortality in the Wider Caribbean. NOAA Tech Memo NMFS-SEFSC-303.

Henwood, T.A. and W. Stuntz. 1987. Analysis of sea turtle captures and mortalities during commercial shrimp trawling. Fishery Bulletin 85(4): 813-817.

Heppell, S.S., D.T. Crouse, L.B. Crowder, S.P. Epperly, and N.B. Frazer. In preparation. Population models for Atlantic loggerheads: past, present and future. In A. Bolten and B. Witherington, eds. Ecology and Conservation of Loggerhead Sea Turtles, Univ. Florida Press (presented at special loggerhead symposium in Orlando, Florida, March 2000).

Hildebrand, H. 1982. A historical review of the status of sea turtle populations in the western Gulf of Mexico, pp. 447-453 in Bjorndal, K., (ed.), Biology and Conservation of Sea Turtles. Proc. World Conf. of Sea Turtle Conserv. Smithsonian Inst. Press. Washington, D.C.

Hildebrand, H.H. Random Notes on Sea Turtles in the Western Gulf of Mexico. Western Gulf of Mexico Sea Turtle Workshop Proceedings, January 13-14, 1983. 1983 Oct:34-41. Note: A copy of the entire Workshop Proceedings is at SP000480.

Hilborn, R. 1998. The economic performance of marine stock enhancement projects. Bulletin of Marine Science, 62(2):661-674.

Hirth, H.F. 1971. Synopsis of biological data on the green turtle *Chelonia mydas* (Linnaeus) 1758. FAO Fisheries Synopsis. 85:1-77.

Hopkins-Murphy, S.R., and T.M. Murphy, Jr. 1988. Status of the loggerhead turtle in South Carolina, p. 35-37. In: B.A. Schroeder (comp.), Proceedings of the Eighth Annual Workshop on Sea Turtle Conservation and Biology. NOAA Tech. Memo. NMFS-SEFSC-214.

Iverson, S., D.M. Allen, and J.B. Higman. 1993. Shrimp capture and culture fisheries of the United States. Imprint of John Wiley & Sons, Inc. New York.

IWC. Committee for Whaling Statistics. 1959-1983. International whaling statistics, volumes 41-91 Comm. Whaling Stat., Oslo, Norway, var. paging.

Jefferson, T.A., S. Leatherwood, and M.A. Webber. 1993. FAO species identification guide. Marine Mammals of the World. Rome: Food and Agriculture Organization.

Johnson, D.R., C. Yeung, and C.A. Brown. 1999. Estimates of marine mammal and marine turtle bycatch by the U.S. Atlantic pelagic longline fleet in 1992-1997. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SEFSC-418, 70 pp.

Katona, S.K. and J.A. Beard. 1990. Population size, migrations, and feeding aggregations of the humpback whale in the western North Atlantic ocean. Rep. IWC Special Issue 12: 295-306.

Keinath, J.A. 1993. Movements and behavior of wild and head-started sea turtles. Ph.D. Diss. College of William and Mary, Gloucester Point, Va., 206 pp.

Klima, E.F. 1986. Summary report on biological impacts of offshore petroleum platform severance using explosives. NMFS Galveston Laboratory.

Klima, E.F., G.R. Gitschlag, and M.L. Renaud. 1988. Impacts of the explosive removal of offshore petroleum platforms on sea turtles and dolphins. Marine Fisheries Review, 50(3) pp 33-42.

Laist, D.W., A.R. Knowlton, J.G. Mead, A.S. Collet, and M. Podesta. 2001. Collisions between ships and whales. Mar. Mamm. Sci. 17: 35-7

Laist, D.W. 1997. Impacts of marine debris: entanglement of marine life in marine debris including a comprehensive list of species with entanglement and ingestion records. In: Coe, J.M. and D.B. Rogers, eds. Marine debris: sources, impacts, and solutions. New York: Springer-Verlag. Pp. 99-139.

Laurent, L, P. Casale, M.N. Bradai, B.J. Godley, G. Gerosa, A.C. Broderick, W. Schroth, B. Schierwater, A.M. Levy, D. Freggii, E.M. Abd El-Mawla, D.A. Hadoud,H.E. Gomati, M. Domingo, M. Hadjichristophorou, L. Kornaraky, F. Demirayak, and Ch. Gautier. 1998. Molecular resolution of marine turtle stock composition in fishery bycatch: a case study in the Mediterranean. Molecular Ecol. 7:1529-1542.

Law, R.J., Fileman, C.F., Hopkins, A.D., Baker, J.R., Harwood, J., Jackson, D.B., Kennedy, S., Martin, A.R. and R.J. Morris. 1991. Concentrations of trace metals in the livers of marine mammals (seals, porpoises and dolphins) from waters around the British Isles. Marine Pollution Bulletin 22:183-191.

Lazell, J.D. 1980. New England waters: critical habitat for marine turtles. Copeia 1980 (2):290-295.

LeBuff, C.R., Jr. 1990. The loggerhead turtle in the eastern Gulf of Mexico. Caretta Research, Inc., Sanibel, Fla, 216 pp.

LeBuff, C.R., Jr. 1974. Unusual nesting relocation in the loggerhead turtle, *Caretta caretta*. Herpetologica 30:29-31.

Leary, T. R. 1957. A schooling of leatherback turtles, *Dermochelys coriacea*, on the Texas coast. Copeia 1957(3):232.

Leatherwood, S. and R.R Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco. 302 pp.

Limpus, C.J., V. Baker, and J.D. Miller. 1979. Movement induced mortality of loggerhead eggs. Herpetelogica 35(4): 335-338.

Lutcavage, M.E., P. Plotkin, B. Witherington, and P.L. Lutz. 1997. Human impacts on sea turtle survival. In: Lutz, P.L. and J.A. Musick, eds. The Biology of Sea Turtles. Boca Raton, Fla.: CRC Press. pp. 387-409.

Lutcavage, M.E., P.L. Lutz, G.D. Bossart, and D.M. Hudson. 1995. Physiologic and clinicopathologic effects of crude oil on loggerhead sea turtles. Arch. Environ. Contam. Toxicol. 28:417-422.

Lutz, P.L., 1987. Effects of ingestion of non-biodegradable debris in sea turtles. Final Report for the U.S. Department of Commerce; RFP No. FSN-5-0178.

Magnuson, J.J., K.A. Bjorndal, W.D. DuPaul, G.L. Graham, D.W. Owens, P.C.H. Pritchard, J.I. Richardson, G.E. Saul, and C.W. West. 1990. Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C. 274 pp.

Mann, T.M. 1977. Impact of developed coastline on nesting and hatchling sea turtles in southeastern Florida. M.S. thesis. Florida Atlantic University, Boca Raton, Fla.

Márquez-M., R. 1990. FAO Species Catalogue, Vol. 11. Sea turtles of the world, an annotated and illustrated catalogue of sea turtle species known to date. FAO Fisheries Synopsis, 125, 81 pp.

Márquez, R., R. Byles, P. Burchfield, N. Thompson, M. Sanchez, J. Diaz, M.A. Carrasco, A.S. Leo, and C. Jimenez. 1995. The Recovery of the Kemp's ridley sea turtle population in the Mexican Beach of Rancho Nuevo, Tamaulipas. Draft submitted to the Marine Turtle Newsletter.

Matos, R., E. Belardo, and G. Roman. 1992. 1991 Annual Report, Vieques Island Sea Turtle Conservation Project With Management Recommendations. Department of Natural and Environmental Resources, San Juan, Puerto Rico. Report to U.S. Naval Station Roosevelt Roads.

McGehee, M.A. 1990. Effects of moisture on eggs and hatchlings of loggerhead sea turtles (*Caretta caretta*). Herpetologica 46(3):251-258.

McKenzie, C., Godley, B.J., Furness, R.W., and D.E. Wells. 1999. Concentrations and patterns of organochlorine contaminants in marine turtles from Mediterranean and Atlantic waters. Marine Environmental Research 47:117-135.

Mead, J.G. 1977. Records of sei and Bryde's whales from the Atlantic coast of the United States, the Gulf of Mexico, and the Caribbean. Rep. Int. Whal. Commn., Special Issue 1: 113-116.

Mendonca, M.T. and L.M. Ehrhart. 1982. Activity, population size and structure of immature *Chelonia mydas* and *Caretta caretta* in Mosquito Lagoon, Florida. Copeia. (1):161-167.

Meylan, A. 1995. Facsimile dated April 5, 1995, to Sandy McPherson, National Sea Turtle Coordinator, U.S. Fish and Wildlife Service, Jacksonville, Fla. Florida Dept. of Environmental Protection, St. Petersburg, Fla.

Mexico. 1966. Instituto Nacional de Investigaciones Biologico-Pesqueras. Programa nacional de marcado de tortugas marinas. Mexico, INIBP:1-39.

Meyers-Schone, L. and B.T. Walton.1994. Turtles as monitors of chemical contaminants in the environment. Rev. Environ. Contam. Toxicol.; 1994, v. 135, p. 93-153

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea Turtle Nesting Activity in the State of Florida. Florida Marine Research Publications, No. 52.

Meylan, A.B. 1984. The Ecology and Conservation of the Caribbean Hawksbill (*Eretmochelys imbricata*). Final Report: WWF Project No. 1499.

Mignucci-Giannoni, A.A., B. Pinto-Rodriguez, M. Velasco-Escudero, R.A. Montoya-Ospina, N.M. Kimenez-Marrero, M.A. Rodriguez-Lopez, E.H. Williams, Jr., and D.K. Odell. 1999. Cetacean strandings in Puerto Rico and the Virgin Islands. J. Cetacean Res. Manage. 1: 191-198.

Mignucci-Giannoni, A.A. 1998. Zoogeography of cetaceans off Puerto Rico and the Virgin Islands. Carib. J. Sci. 34: 173-190.

Mignucci-Giannoni, A.A. 1996. Marine mammal strandings in Puerto Rico and the United States and British Virgin Islands. PhD thesis, University of Puerto Rico, Mayaguez Campus.

Mignucci-Giannoni, A.A. 1989. Zoogeography of marine mammals in Puerto Rico and the Virgin Islands. M.S. thesis, Univ. Rhode Island. 448 pp.

Miller, G.S. 1991. The bow shock environment from a 16-inch projectile flyby. NSWC Technical Report TR91-621, October.

Miller, K., G.C. Packard, and M.J. Packard. 1987. Hydric conditions during incubation influence locomotor performance of hatchling snapping turtles. Journal of Experimental Biology 127:401-412.

Milton, S. L., S. Leone-Kabler, A.A. Schulman, and P.L. Lutz. 1994. Effects of Hurricane Andrew on the sea turtle nesting beaches of South Florida. Bulletin of Marine Science 54-3: 974-981.

Moncada-G., A. Rodriguez, R. Marquez-M., and E. Carrillo. 2000. Marine Turtle Newsletter No. 90, pp. 13-15.

Morreale, S.J. 1993. Personal Communication. Cornell University, Ithaca, New York.

Morreale, S.J. and E.A. Standora. 1999. Vying for the same resources: potential conflict along migratory corridors. U.S. Dep. Commer. NOAA Tech. Mem. NMFS-SEFSC-415: 69.

Morreale, S.J. and E.A. Standora. 1998. Early life stage ecology of sea turtles in northeastern U.S. waters. U.S. Dep. Commer. NOAA Tech. Mem. NMFS-SEFSC-413, 49 pp.

Mrosovsky, N. and A. Carr. 1967. Preference for light of short wavelengths in hatchling green sea turtles (*Chelonia mydas*) tested on their natural nesting beaches. Behavior 28:217-231.

Mrosovsky, N. and S.J. Shettleworth. 1968. Wavelength preferences and brightness cues in water-finding behavior of sea turtles. Behavior 32:211-257.

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships, p.111- 322. In R.W. Davis, W.E. Evans, and B. Wursig, eds. Cetaceans, sea turtles and seabirds in northern Gulf of Mexico: distribution, abundance and habitat associations. Unpublished report. USGS/BRD/CR-1999-0006, OCS Study MMS 2002-002. Department of Marine Biology, Texas A&M University, Galveston, Texas.

Mullin, K.D., W. Hoggard, C.L. Roden, R.R. Lohoefener, C.M. Rogers, and B. Taggart. 1994. Cetaceans on the upper continental slope in the north-central GOM. Fishery Bulletin 92: 773-786.

Munsell, E. 2000. Department of the Navy. Deputy Assistant Secretary of the Navy for Installations and Environment. Personal Communication to Eric Hawk, NMFS. October 12.

NMFS & FWS. 1998. Recovery Plan for U.S. Pacific populations of the olive ridley sea turtle (*Lepidochelys olivacea*). NMFS, Silver Spring, MD.

NMFS & FWS. 1992. Recovery Plan for leatherback turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico. NMFS, Washington, D.C.

NMFS & FWS. 1991. Recovery plan for the U.S. population of loggerhead turtle. National Marine Fisheries Service, Washington, D.C.

National Research Council. 1990. Decline of the sea turtles: Causes and prevention. National Academy Press, Washington, D.C., 259 p.

NMFS. 2001. Endangered Species Act Section 7 Reinitiation of consultation on the Atlantic Highly Migratory Species Fishery Management Plan and its Associated Fisheries. Biological Opinion. June 8.

NMFS SEFSC. 2001. Southeast Fisheries Science Center. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. U.S. Department of Commerce, National Marine Fisheries Service, Miami, Fla, SEFSC Contribution PRD-00/01-08; Parts I-III and Appendices I-V1.

NMFS. 2000. Endangered Species Act Section 7 consultation on the Atlantic Pelagic Fisheries for Swordfish, Tuna, Shark, and Billfish in the U.S. Exclusive Economic Zone. Biological Opinion. June 30.

NMFS. 2000b. Endangered Species Act Section 7 consultation on the proposed shock testing of the DDG-81 WINSTON CHURCHILL destroyer. Biological Opinion. October 10.

NMFS. 2000. E-mail from Wendy Teas to Terri Jordan regarding loggerhead turtle strandings in Puerto Rico since 1990.

NMFS. 1998. Turtle Expert Working Group, An Assessment of the Kemp's ridley (*Lepidochelys kempii*) and Loggerhead (*Caretta caretta*) Sea Turtle Populations in the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-409. 96 pp.

NMFS. 1998. Recovery plan for the blue whale (*Balaenoptera musculus*). Prepared by R.R. Reeves, P.J. Clapham, R.L. Brownell, and G.K. Silber for the National Marine Fisheries Service, Silver Spring, MD. 39 pp.

NMFS. 1998. Endangered Species Act Section 7 consultation on shrimp trawling in the southeastern U.S. under the sea turtle conservation regulations. Biological Opinion, March 24. 32 pp.

NMFS. 1997a. Endangered Species Act Section 7 consultation on Navy activities off the southeastern United States along the Atlantic Coast, May 15. 73 pp.

NMFS. 1997b. Endangered Species Act Section 7 consultation on the Atlantic Pelagic Fishery for Swordfish, Tuna, and Shark, in the Exclusive Economic Zone. Biological Opinion, May 29. 95 pp.

NMFS. 1997c. Endangered Species Act Section 7 consultation on the continued hopper dredging of channels and borrow areas in the southeastern United States. Biological Opinion, September 25. 15 pp.

NMFS. 1997e. Endangered Species Act Section 7 consultation on the continued operation of the circulating water system of the St. Lucie nuclear generating plant. Biological Opinion, February 7. 39 pp.

NMFS. 1996a. Endangered Species Act Section 7 consultation on the Fishery Management Plan (FMP) for Summer Flounder to include the management and fishing activities under the Draft FMPs for Scup and Black Sea Bass. Biological Opinion.

NMFS. 1996b. Endangered Species Act Section 7 consultation on the proposed shock testing of the U.S.S. SEAWOLF submarine off the Atlantic Coast of Florida during the summer of 1997. Biological Opinion, December 12. 50 pp.

NMFS. 1995. Endangered Species Act Section 7 consultation on United States Coast Guard vessel and aircraft activities along the Atlantic coast. Biological Opinion, September 15. 56 pp.

NMFS. 1995a. Endangered Species Act Section 7 consultation on channel maintenance dredging using a hopper dredge in the Galveston and New Orleans Districts of the Army Corps of Engineers. Biological Opinion, September 22. 23 pp.

NMFS. 1991. Recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the Humpback Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, MD. 105 pp.

NMFS. 1991a. Endangered Species Act Section 7 consultation on Corps of Engineeers' dredging of channels in the southeastern United States from North Carolina through Cape Canaveral, Florida. Biological Opinion, November 25, 1991. 28 pp.

NRC. 1990. National Research Council (USA), Committee on Sea Turtle Conservation. Decline of the Sea Turtles: Causes and Prevention. National Academy Press, Washington DC.

NWS. 1999. National Weather Service. Hurricane Georges Preliminary Storm Report. From the Tropical Atlantic to the United States Virgin Islands and Puerto Rico.

Norrgard, J. 1995. Determination of stock composition and natal origin of a juvenile loggerhead turtle population (*Caretta caretta*) in Chesapeake Bay using mitochondrial DNA analysis. M.S. Thesis, College of William and Mary, Gloucester Point, Virginia. 47 pp.

Norris and Mohl. 1983. Can odontocetes debilitate prey with sound? American Naturalist. 122(1): 85-104.

Ogren, L.H. Biology and Ecology of Sea Turtles. 1988. Prepared for National Marine Fisheries, Panama City Laboratory. September 7.

Oravetz, C. 2001. Personal communication to Eric Hawk, NMFS, St. Petersburg, Fla.

Packard, G.C., M.J. Packard, K. Miller, and T.J. Boardman. 1988. Effects of temperature and moisture during incubation on carcass composition of hatchling snapping turtles (*Chelydra serpentina*). Journal of Comparative Physiology B 158:117-125.

Packard, G.C., M.J. Packard, T.J. Boardman, and MD. Ashen. 1981. Possible adaptive value of water exchange in flexible-shelled eggs of turtles. Science 213:471-473.

Paladino, F.V., M.P. O'Connor, and J.R. Spotila. 1990. Metabolism of leatherback turtles, gigantothermy and thermoregulation of dinosaurs. Nature 344:858-860.

Palsboll, P.J. J. Allen, M. Berube, P.J. Clapham, T.P Feddersen, et al. 197. Genetic tagging of humpback whales. Nature 388: 767-769.

Parsons, J.J. 1962. The green turtle and man. Gainesville, University of Florida Press.

Pater, L.L. 1981. Gun blast far field peak overpressure contours. NSWC TR79-442. Combat Systems Department, Naval Surface Weapons Center, Dahlgren, VA. March.

Peters, J.A. 1954. The amphibians and reptiles of the coast and coastal sierra of Michoacan, Mexico. Occ. Pap. Mus. Zool. 554:1-37.

Philbosian, R. 1976. Disorientation of hawksbill turtle hatchlings (*Eretmochelys imbricata*) by stadium lights. Copeia 1976:824.

Pilling, D. 2000. Captitol Hill Hearing Testimony by Admiral Donald Pilling, February 29.

Plotkin, P.T. 1995. Personal Communication. Drexel University, Philadelphia, Pennsylvania.

Plotkin, P.T., M.K. Wicksten, and A.F. Amos. 1993. Feeding ecology of the loggerhead sea turtle *Caretta caretta* in the Northwestern Gulf of Mexico. Marine Biology 115: 1-15

Plotkin, P. and A.F. Amos. 1990. Effects of anthropogenic debris on sea turtles in the northwestern Gulf of Mexico. *in* R.S. Shomura and M.L. Godfrey (eds.). Proceedings of the Second International Conference on Marine Debris. NOAA Tech. Memo NMFS- SWFSC-154: 736-743.

Plotkin, P. and A.F. Amos. 1988. Entanglement in and ingestion of marine debris by sea turtles by sea turtles stranded along the south Texas coast. The Eighth Annual Workshop on Sea Turtle Conservation and Biology, Fort Fisher, North Carolina.

Prescott, R.L. 1988. Leatherbacks in Cape Cod Bay, Massachusetts, 1977-1987. In: Schroeder, B.A. (compiler). Proceedings of the Eighth Annual Workshop on Sea Turtle Conservation and Biology. NOAA Tech. Memo. NMFS-SEFC-214:83-84.

Pritchard, P.C.H. 1969. Sea turtles of the Guianas. Bull. Fla. State Mus. 13(2):1-139.

Provancha, J. 1998. Annual report for sea turtle nesting in Mosquito Lagoon. Kennedy Space Center Florida.

Provancha, J. 1997. Annual report for sea turtle nesting in Mosquito Lagoon. Kennedy Space Center Florida.

Quantum Resources, Inc. 1994. Florida Power & Light Co., St. Lucie Unit 2 annual environmental operating report. Prepared by Quantum Resources, Inc. for Florida Power & Light Co. Juno Beach, Florida. Vol. 1, 49 pp.

Rankin-Baransky, K.C. 1997. Origin of loggerhead turtles (*Caretta caretta*) in the western North Atlantic as determined by mt DNA analysis. M.S. Thesis, Drexel University, Philadelphia, Penn.

Rebel, T.P. 1974. Sea turtles and the turtle industry of the West Indies, Florida and the Gulf of Mexico. Univ. Miami Press, Coral Gables, Florida.

Rice, D.W. Sperm Whale – *Physeter macrocephalus* Linnaeus, 1758. In: S. H. Ridgway and R. Harrison. Handbook of Marine Mammals. Vol. 4: River Dolphins and the Larger Toothed Whales. Academic Press, London. pp. 177 - 234.

Richardson, J.I. 1982. A population model for adult female loggerhead sea turtles (*Caretta caretta*) nesting in Georgia. Ph.D. Dissertation, University of Georgia, Athens, Georgia, 204 pp.

Richardson, J.I. and T.H. Richardson. 1982. An experimental population model for theloggerhead sea turtle (*Caretta caretta*), pp. 165-174. In K.A. Bjorndal, ed. Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C.

Roden, C.L. and K.D. Mullin. In press. Sightings of cetaceans in the northern Caribbean Sea and adjacent waters, Winter 1995. Carib. J. Sci.

Ross, J.P. and M.A. Barwani. 1982. Review of sea turtles in the Arabian area. In: Bjorndal, K.A. (editor), Biology and Conservation of Sea Turtles. pp. 373-383. Smithsonian Institution Press, Washington, D.C. 1995.

Ryder, C. 1995. Personal Communication. NMFS Northeast Fisheries Science Center.

Sakai, H., Ichihashi, H., Suganuma, H., and R. Tatsukawa. 1995. Heavy metal monitoring in sea turtles using eggs. Marine Pollution Bulletin 30:347-353.

Salmon, M., and J. Wyneken. 1990. Orientation by Swimming Sea Turtles: Role of Photic Intensity Differences While Near-shore. Proceedings of the Tenth Annual Workshop on Sea Turtle Biology and Conservation. NOAA Tech. Memo SEFSC-278. pp: 107-108

Sarti M., L., S.A. Eckert, N. Garcia T., A.R. Barragan. 1996. Decline of the world's largest nesting assemblage of leatherback turtles. Marine Turtle Newsletter 74: 2-5.

Schmidley, D.J. 1981. Marine mammals of the southeastern United States and the Gulf of Mexico. U.S. Fish and Wildlife Service. Office of Biological Services, Washington, DC, FWS/OBS-80/41, 165 pp.

Schmidt, H. 2000. Professor and Acting Head of Ocean Engineering, Massachusetts Institute of Technology. E-mail to Eric Hawk, NMFS, St. Petersburg, Fla.

Schroeder. B.A. 2000. Personal Communication to Anne Meylan, Florida Department of Environmental Protection, FMRI, St. Petersburg, Florida.

Schroeder. B.A. 1995. Personal Communication. Florida Department of Environmental Protection. Tequesta, Florida.

Schroeder, B.A. 1994. Florida index nesting beach surveys: are we on the right track? Pages 132-133 in Bjorndal, K.A., A.B. Bolten, D.A. Johnson, and P.J. Eliazar (compilers). Proceedings of the 14th Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-351.

Schroeder, B.A., A.M. Foley, B.E. Witherington, and A.E. Mosier. 1998. Ecology of marine turtles in Florida Bay: Population structure, distribution, and occurrence of fibropapilloma. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SEFSC-415:265-267.

Schultz, J.P. 1975. Sea turtles nesting in Surinam. Zoologische Verhandelingen (Leiden), Number 143: 172 pp.

Sears, C.J. 1995. Preliminary genetic analysis of the population structure of Georgia loggerhead sea turtles. Presented at the Fifteenth Annual Symposium of Sea Turtle Biology and Conservation, February 1995, Hilton Head, SC.

Sears, C.J. 1994. Preliminary genetic analysis of the population structure of Georgia loggerhead sea turtles. U.S. Dep. Commer. NOAA Tech. Memo NMFS-SEFSC-351:135-139.

Sears, C.J., B.W. Bowen, R.W. Chapman, S.B. Galloway, S.R. Hopkins-Murphy, and C.M. Woodley. 1995. Demographic composition of the juvenile loggerhead sea turtle (*Caretta caretta*) feeding population off Charleston, South Carolina: evidence from mitochondrial DNA markers. Mar. Biol. 123:869-874.

Shaver, D.J. 2000. Personal communication regarding Head Start turtles nesting on Padre Island, Texas.

Shaver, D.J. 1994. Sea turtle abundance, seasonality and growth data at the Mansfield Channel, Texas. In B.A. Schroeder and B.E. Witherington (compilers), Proceedings of the thirteenth annual symposium on sea turtle biology and conservation, NOAA Tech. Memo NMFS-SEFC-341: 166-169.

Shaver, D.J. 1991. Feeding ecology of wild and head-started Kemp's ridley sea turtles in south Texas waters. Journal of Herpetology. Vol. 23. 1991.

Shoop, C.R. and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs. 6:43-67.

Simpendorfer, C.A. 2000. Predicting population recovery rates for endangered western Atlantic sawfishes using demographic analyses. Environmental Biology of Fishes 58:371-377.

Simpendorfer, C.A. 2001. Essential habitat of smalltooth sawfish (*Pristis pectinata*). Mote Marine Laboratory Technical Report 786, November 2001. 21pp.

Smith, T.D., J.Allen, P.J. Clapham, S. Katona, F. Larsen, J. Lien, D. Mattila, et al. 1997. An ocean-basin wide mark-recapture study of the North Atlantic humpback whale. Mar. Mammal Sci. 15(1):1-32.

South, C. and S. Tucker. 1991. Personal communication regarding sea turtle nesting in the state of Alabama. U.S. Fish and Wildlife Service, Daphne Field Office, Alabama.

Stanley. K.M., E.K. Stabenau, and A.M. Landry. 1988. Debris ingestion by sea turtles along the Texas Coast. Eighth Annual Workshop on Sea Turtle Conservation and Biology, Fort Fisher, North Carolina.

Standora, E.A., S.J. Morreale, A. Bolten, M.D. Eberle, J.M. Edbauer, T.S. Ryder; and K.L. Williams. 1993 Diving behavior, daily movements, and homing of loggerhead turtles (Caretta caretta) at Cape Canaveral, Florida. March and April 1993. Contr. Report to COE.

Starr-Hillis, Z. 2000. Personal communication to Anne Meylan, Florida Marine Research Institute, FMRI. St. Petersburg, Fla.

Stabenau, E.K. and K.R. Vietti. 1999. Physiological effects of short-term submergence of loggerhead sea turtles, *Caretta caretta*, in TED-equipped commercial fishing nets. Final Report to National Marine Fisheries Service, Pascagoula Laboratory, Pascagoula, Mississippi.

Storelli, M.M., E.Ceci and G.O. Marcotrigiano. 1998. Distribution of heavy metal residues in some tissues of *Caretta caretta* (Linnaeus) specimens beached along the Adriatic Sea (Italy). Bulletin of Enviromental Contamination and Toxicology 60:546-552.

Swingle, W.M., S.G. Barco, T.D. Pitchford, W.A. McLellan, and D.A. Pabst. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. Mar. Mamm. Sci. 9: 309-315.

Teas, W. 2000. NMFS SEFSC, Personal Communication to Eric Hawk, NMFS St. Petersburg, Fla.

Teas, W.G. and A. Martinez. 1992. Annual report of the sea turtle stranding and salvage network Atlantic and Gulf coasts of the United States, January-December 1989.

Thompson, N.B., and H. Huang.1993. Leatherback turtles in southeast U.S. waters. NOAA Tech. Mem. NMFS-SEFSC-318. 11pp.

Townsend, C.H. 1935. The distribution of certain whales as shown by logbook records of American whale ships. Zoologica 19: 1-50.

Turtle Expert Working Group. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. U.S. Dep. Commer. NOAA Tech. Mem. NMFS-SEFSC-444, 115 pp.

Turtle Expert Working Group. 1998. (Byles, R., C. Caillouet, D. Crouse, L. Crowder, S. Epperly, W. Gabriel, B. Gallaway, M. Harris, T. Henwood, S. Heppell, R. Marquex-M, S. Murphy, W. Teas, N. Thompson, and B. Witherington). An Assessment of the Kemp's ridley sea turtle (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. U.S. Dep. Commer. NOAA Tech. Mem. NMFS-SEFSC-409, 96 pp.

Underwood, G. 1951. Introduction to the study of Jamaican reptiles. Part 5. Nat. Hist. Notes Nat. Hist. Soc. Jamaica. 46:209-213.

U.S. Atomic Energy Commission. 1974. Final environmental statement related to construction of St. Lucie Plant Unit 2, Docket No. 50-389. USAEC, Directorate of Licensing. Washington, D.C.

Vargo, S., P. Lutz, D. Odell, E. Van Vleep and G. Bossart. 1986. Final report: Study of effects of oil on marine turtles. Tech. Rep. O.C.S. study MMS 86-0070. Vol. 2, 181pp.

Vicente, V.P. 1993. Spongivory in Caribbean hawksbill turtles, *Eretmochelys imbricata*: data from stranded specimens. Extended abstract for Proceedings: Thirteenth Annual Symposium on Marine Turtle Biology and Conservation. NOAA NMFS, Suite 1108, Banco de Ponce Building, Hato Rey, Puerto Rico 00918.

Wallmeyer, J. 2001. U.S. Navy Environmental Division, USN Southeast Region, Jacksonville, Florida. Personal communication to Eric Hawk, NMFS, St. Petersburg, Fla.

Wallmeyer, J. 2000. U.S. Navy Environmental Division, USN Southeast Region, Jacksonville, Florida. Personal communication to Eric Hawk, NMFS, St. Petersburg, Fla.

Waring, G.T., J.M. Quintal,and S.L. Swartz (Editors). 2000. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments. NOAA Technical Memorandum NMFS-NE-162. November. 303 pp.

Waring, G.T., D.L. Palka, P.J. Clapham, S. Swartz, M. Rossman, T.V.N. Cole, L.J. Hansen, K.D. Bisack, K.D. Mullin, R.S. Wells, and N.B. Barros. 1999. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments. NOAA Technical Memorandum NMFS-NE-153. October.

Appendix 2:
Revision 2 to November 19, 2003, biological opinion. January 9, 2007.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701
(727) 824-5312; FAX 824-5309
http://sero.nmfs.noaa.gov

JAN - 9 2007 F/SER3:EH

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

Dear General Schroedel:

This responds to the U.S. Army Corps of Engineers' (COE), South Atlantic Division (SAD) e-mail request dated May 31, 2006, by Mr. Dennis Barnett of your Planning and Policy Division (PPD) to Mr. Eric Hawk of my Protected Resources Division (PRD). Mr. Barnett, acting as spokesperson for the three COE divisions containing the four COE Gulf of Mexico districts, submitted COE-requested changes to the current National Marine Fisheries Service (NMFS) Gulf of Mexico hopper dredging regional biological opinion (GRBO), issued November 19, 2003. Our response also addresses the Endangered Species Act (ESA) section 7(a)(2)/7(d) analysis submitted by e-mail on September 12, 2006, by Mr. Daniel Small of COE PPD in response to a take of a federally-listed smalltooth sawfish on August 12, 2006, by a COE-authorized relocation trawler during Tampa Harbor Entrance Channel maintenance dredging. A June 27, 2006, conference call and numerous subsequent e-mails, phone calls, and sharing of ideas between our respective staffs resulted in Revision 2 to the GRBO, enclosed herein.

NMFS previously amended the GRBO on June 24, 2005 (Revision 1). The COE requested additional changes to address remaining issues of concern, specifically: 1) GRBO-required funding for genetic testing of tissue samples collected from sea turtles taken on COE projects or COE-permitted projects; and 2) the methodology of how applicants on COE permits will be involved in consultation discussions regarding authorized levels of protected species take. Other COE requests included, specifically: 1) A request for a 25-percent annual overage of authorized take under the GRBO for any one calendar year, as long as the total anticipated take for the encompassing 5-year period was not exceeded; and 2) a request that the GRBO be revised to authorize relocation trawling takes of smalltooth sawfish. Currently, the GRBO authorizes takes of federally-listed sea turtles and Gulf sturgeon, but not smalltooth sawfish.

The COE and NMFS agreed during their conference call to hold the COE request for a 25-percent overage in abeyance pending significant additional analysis needed by both the COE and NMFS. Because these analyses will require significant additional effort and time, it was agreed to proceed with resolving those high-priority issues that can be addressed with a simple revision to the Incidental Take Statement (ITS). However, it will be reconsidered during NMFS' reinitiation of formal consultation on the GRBO to analyze the effects of the COE's request for an increase in its currently authorized non-lethal relocation trawling take limits for sea turtles and Gulf sturgeon. At that time, NMFS will also consider the COE's requested increase in its lethal relocation trawling take limit for sea turtles and its request for relocation trawling take authority for smalltooth sawfish. Increased take limits and take authority for species not included in the GRBO's ITS cannot be authorized without a thorough effects assessment and jeopardy analysis.

With respect to the COE's concern about genetic sampling, NMFS agrees that the GRBO requirement for COE funding of genetic sampling be modified because the COE has provided evidence that it cannot, within its current fiscal authority, fund this requirement. The COE, however, agrees to require the collection and shipment to NMFS for genetic analysis of tissue samples from all sea turtles and Gulf sturgeon taken by hopper dredges and relocation trawlers until NMFS, in consultation with COE scientists, determines they are no longer needed. The GRBO has been modified accordingly; this requirement has been included in the reasonable and prudent measures of the ITS.

With respect to applicant participation in the ESA consultation process and input into permitted-project protected species take levels, the COE will coordinate with NMFS prior to permit issuance. The COE will forward draft permit conditions to NMFS that are consonant with the RPMs and terms and conditions of the GRBO, including a proposed amount of authorized take of sea turtles and Gulf sturgeon per project allocated from the overall annual authorized take limit. Currently the COE's sea turtle and Gulf sturgeon take database and NMFS' take records are useful for estimation purposes, but are still too incomplete to support analyses to accurately predict particular dredging project protected species takes levels with any degree of certainty.

As requested by the COE and based on information provided by the COE with input from NMFS, Revision 2 segregates the previously established Gulf-wide protected species take limits into two allotments – one for COE civil works projects and one for COE-permitted projects. The COE retains the authority and flexibility to manage the allotment ratio, initially set at 80:20 (i.e., 80% for civil, 20% for permitted) for the combined Gulf districts, and adjust them yearly as necessary within the established ITS ceiling, according to its operational needs and its own internal hopper dredging protocol, in coordination with NMFS.

At the COE's request, NMFS' partitioning of the GRBO's Gulf-wide authorized take level into fixed allotments for each of the four COE districts has been superseded by the 80:20 ratio allotment take-limit scheme described above. Revision 2 includes NMFS' estimates of *anticipated* take by each district, unchanged from the original GRBO; however, NMFS has eliminated the district-level protected species allocations, where each district formerly held a guaranteed share of the Gulf-wide authorized level of per-fiscal-year take. The COE is developing an internal protocol to handle within-year management and sharing of takes between Gulf of Mexico COE districts. Other minor modifications to the GRBO and noteworthy changes included in Revision 2 are:

1) The COE is no longer required to consult with/notify NMFS whenever it deviates from the recommended hopper dredging windows (T&C 1).
2) Notification to NMFS and transmittal of information on protected species takes by hopper dredge can now occur by electronic mail to **takereport.nmfsser@noaa.gov** (T&C 9).
3) Any strandings or relocation trawler takes of protected species bearing evidence of potential dredge interaction, regardless of type of dredge implicated, shall not be counted against the GRBO's ITS (T&C 10), although the reporting requirement remains unchanged (T&C 11).
4) The minimum dimensions for a seawater holding tank for captured Gulf sturgeon have been eliminated and more flexible, protective standards have been instituted (T&C 15-f).
5) The GRBO is now the permitting authority to conduct PIT tagging; an ESA Section 10 permit is no longer required to conduct PIT tagging (T&C 15-h, T&C 15-i, T&C 16).
6) Submission requirements for PIT tag scan and external tag data, and genetic samples, have been standardized, to within 60 days after project completion (T&C 15-j, T&C 16).
7) The definition of hardgrounds is clarified to exclude navigation channels and jettys (T&C 17).

In addition, there are some minor changes to address inconsistent or unclear language use in the original GRBO: e.g., the terms "NMFS-approved observer," "observer," and "endangered species observer," have been standardized/changed to "NMFS-approved protected species observer." Other minor language changes clarify that weighing/measuring/sampling of protected species is only required when it can be done safely (T&C 15-d, T&C 20), and that NMFS-approved protected species observers are not required to take tissue samples of sea turtle viral fibropapillomas when these are encountered (T&C 15-l). Finally, NMFS encourages the COE to make fuller use of protected species taken during hopper dredging and relocation trawling by allowing and encouraging duly-permitted "piggy-back" research projects on protected species taken during these activities (T&C 15-d, Conservation Recommendation 5).

Revision 2 to the GRBO is enclosed. It replaces and supersedes Revision 1, and replaces and supersedes the corresponding sections of the 2003 GRBO. If you have any questions, please contact Eric Hawk at (727) 551-5773 or by e-mail at Eric.Hawk@noaa.gov.

We sincerely appreciate all the COE's past and ongoing protected species conservation efforts during hopper dredging activities in the Gulf and South Atlantic, and look forward to continued collaborative efforts to preserve our protected species. My compliments to your staff at SAD, in particular Mr. Daniel Small, and in the four Gulf of Mexico COE districts for working assiduously and effectively with NMFS staff, which enabled us to resolve your remaining concerns with the GRBO. We look forward to working closely with the COE to facilitate other activities, including reinitiation of consultation on the South Atlantic Regional Biological Opinion on hopper dredging, while conserving endangered and threatened species.

I would especially like to take this opportunity to applaud and congratulate the U.S. Army Corps of Engineers, and especially Dr. Dena Dickerson and her staff at the Environmental Data Research Center in Vicksburg, Mississippi, for the excellent job they have done developing and maintaining the COE's Sea Turtle Data Warehouse. The wealth of historic and current information contained in this database regarding hopper dredging project/protected species interactions, and the ease of use of the Sea Turtle Data Warehouse Website, has been exceedingly valuable to NMFS, and will continue to be very useful to both our agencies when making management and conservation decisions regarding protected species.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure

cc: COE SAD, Atlanta - Daniel Small, Dennis Barnett
COE MVD, Vicksburg
COE SWD, Dallas
COE, Mobile District – Susan Ivester Rees
COE, Galveston District – Carolyn Murphy
COE, Jacksonville District – Marie Burns, Terri Jordan
COE, New Orleans District – Linda Mathies
F/PR2 – Barbara Schroeder
F/SEC3 – Sheryan Epperly Chester

File: 1514-22.f.1.GOM, SAD
Ref: I/SER/2006/02953; I/SER/2006/01096

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

Revision 2 to the National Marine Fisheries Service (NMFS) November 19, 2003, Gulf of Mexico Regional Biological Opinion (GRBO) to the U.S. Army Corps of Engineers (COE) on Hopper Dredging of Navigation Channels and Borrow Areas in the U.S. Gulf of Mexico

The followings replaces parts of the original GRBO and supersedes Revision 1 to the GRBO. All replacements/revisions noted below are to be made to the November 19, 2003, biological opinion. Revision 1 should be discarded in its entirety.

REPLACE:
Anticipated Gulf-wide Take of Sea Turtles and Gulf Surgeon by Hopper Dredges (in Section 5, pp. 57-58 of GRBO), with the following:

Anticipated Gulf-wide Take of Sea Turtles and Gulf Sturgeon by Hopper Dredges and Bed-leveling associated with Hopper Dredging Projects:

For the entire Gulf of Mexico from the U.S.-Mexico border to Key West, the annual documented COE incidental take per fiscal year, by injury or mortality, is expected to consist of twenty (20) Kemp's ridley turtles, fourteen (14) green turtles, four (4) hawksbill turtles, forty (40) loggerhead turtles, and four (4) Gulf sturgeon. This take level represents a total take per fiscal year for all channel dredging and sand mining by hopper dredges in the Gulf of Mexico under the purview of the COE's Galveston, New Orleans, Mobile, and Jacksonville Districts collectively. These totals include hopper dredging activities conducted by the COE (for maintenance of civil works and military navigation channels and for construction of federally-authorized hurricane-storm damage reduction projects) and performed by non-federal interests under COE permits (i.e., "regulatory" projects), including any bed-leveling associated with these hopper dredging activities. These totals are based on the following estimates of anticipated take levels in the Gulf of Mexico, by region, which are not allotments or limits per se. Subdivision of the COE's Gulf-wide anticipated incidental take is made later in this opinion, into two distinct and separate levels or allotments: one for COE-conducted ("civil works and national defense") projects, and the other for COE-permitted ("regulatory") projects.

Texas Coastal Area
For this area, the annual documented incidental take, by injury or mortality, is expected to consist of seven (7) Kemp's ridleys, five (5) green turtles, one (1) hawksbill, and fifteen (15) loggerhead turtles.

Louisiana Coastal Area
For this area, the documented annual incidental take, by injury or mortality, is expected to consist of seven (7) Kemp's ridleys, three (3) green turtles, one (1) hawksbill, and fifteen (15) loggerhead turtles, and one (1) Gulf sturgeon.

Florida Panhandle Coastal Area, west of Aucilla River Basin; Alabama Coastal Area; and Mississippi Coastal Area
For these areas, combined, the documented annual incidental take, by injury or mortality, is expected to consist of three (3) Kemp's ridley, three (3) green turtles, one (1) hawksbill, five (5) loggerhead turtles, and two (2) Gulf sturgeon.

West Florida Coastal Area: Aucilla River Basin to, but not including, Key West
For this area, the documented annual incidental take, by injury or mortality, is expected to consist of three (3) Kemp's ridleys, three (3) green turtles, one (1) hawksbill, five (5) loggerhead turtles, and one (1) Gulf sturgeon. Hopper dredging of Key West navigation channels is covered under the September 25, 1997, regional hopper dredging biological opinion (RBO) to the COE's South Atlantic Division (SAD), which includes by reference the reasonable and prudent measures (RPMs) of the August 25, 1995, hopper dredging RBO to the SAD.

REPLACE:
Anticipated Gulf-wide Take by Hopper Dredging Activities (in Section 8, pp. 63-65 of GRBO), with the following:

8.1 Anticipated Gulf-wide Take by Hopper Dredging and Bed-leveling and Relocation Trawling Activities Associated with Hopper Dredging Projects:

For the entire Gulf of Mexico from the U.S.-Mexico border to Key West, the annual documented COE incidental take per fiscal year, by injury or mortality, is expected to consist of forty (40) loggerhead turtles, twenty (20) Kemp's ridley turtles, fourteen (14) green turtles, four (4) hawksbill turtles, and four (4) Gulf sturgeon. This take level represents total take by injury or mortality per fiscal year anticipated for all navigation channel maintenance dredging and sand mining by hopper dredges and any associated bed-leveling activity in the Gulf of Mexico within the COE's Galveston, New Orleans, Mobile, and Jacksonville Districts, by COE-conducted ("civil works and national defense") projects and COE-permitted ("regulatory") projects.

Based upon consultation with the COE, the annual documented lethal or injurious incidental take per fiscal year is allocated as follows:

8.1.1 For COE-*conducted* hopper dredging for federal civil works or national defense activities:

Thirty-two (32) loggerhead turtles, sixteen (16) Kemp's ridley turtles, eleven (11) green turtles, three (3) hawksbill turtles, and three (3) Gulf sturgeon.

8.1.2 For COE-*permitted* hopper dredging performed by others (i.e., non-COE entities):

Eight (8) loggerhead turtles, four (4) Kemp's ridley turtles, three (3) green turtles, one (1) hawksbill turtle, and one (1) Gulf sturgeon.

8.1.3 For relocation trawling:

Zero to two (2) turtles and zero to one (1) Gulf sturgeon. These numbers are in addition to anticipated lethal or injurious takes by hopper dredges noted in 8.1.1 and 8.1.2, above.

8.1.4 For relocation trawling, the following non-lethal take is anticipated/authorized per fiscal year.

Three hundred (300) sea turtles, of any combination of species (Kemp's ridley, green, loggerhead, leatherback, and hawksbill), and eight (8) Gulf sturgeon, across all the COE districts and hopper dredging projects. This take is limited to relocation trawling conducted during the 0-3 days immediately preceding the start of hopper dredging (as a means to determine/reduce the initial abundance of sea turtles in the area and determine if additional trawling efforts are needed), during actual hopper dredging, and during "down" times when the hopper dredging operations may be temporarily suspended due to lethal turtle/sturgeon takes, weather, hopper dredge mechanical problems, etc. Relocation trawling performed to reduce endangered species/hopper dredge interactions is subject to the requirements detailed in the terms and conditions of this opinion.

Regulatory Permits

Each COE district issuing a regulatory permit involving hopper dredging will be responsible for initiating contact with NMFS on behalf of permit applicants, and will forward draft permit conditions to NMFS that are consonant with the RPMs and terms and conditions of this Regional Biological Opinion, including a proposed amount of authorized take of sea turtles and Gulf sturgeon where applicable per project allocated from the overall annual authorized take limit. The COE will coordinate with NMFS prior to permit issuance. This may be done by electronic mail with an electronic response from NMFS. The draft permit conditions and proposed take level allocated may be of standardized content.

COE Gulf of Mexico Hopper Dredging Protocol

The COE will develop internal protocols for managing, documenting, reporting, and coordinating incidental takes for both COE-conducted and COE-permitted activities across Gulf of Mexico Districts to ensure compliance with the provisions of this Regional Biological Opinion. The protocol and any future revisions to it will be shared with the NMFS Southeast Regional Office, Protected Resources Division staff in a timely manner.

Adjustment of Take Allocations

The balance between the basic hopper dredging requirements (quantities, duration, timing, and locations) for COE-conducted dredging for civil works and national defense and for COE-permitted dredging may vary in the future. Based on annual changes in these requirements, the COE may, in coordination with NMFS, adjust the allocation of the authorized Gulf-wide incidental take numbers between COE-conducted hopper dredging and COE-permitted hopper dredging in advance of any given fiscal year, such that changes could be made to the allotments for the start of the subsequent fiscal year. Such adjustments would not affect the jeopardy analysis of this opinion or the terms and conditions of this ITS and can be made without reinitiation of consultation on this opinion.

New information requiring subsequent reinitation of consultation on this opinion, pursuant to the reinitiation triggers of 50 CFR 402.16, could result in an increase or decrease of the total allocated incidental take numbers for COE-conducted or COE-permitted hopper dredging within the current authorized ITS limit.

REPLACE:
Terms and Conditions (in Section 9, pp. 72-78 in the GRBO), Section 10 (Conservation Recommendations, pp. 78-80 in the GRBO), and Section 11 (Reinitiation of Consultation, pp. 80-81 in the GRBO), with the following:

Terms and Conditions

1. *Hopper Dredging*: Hopper dredging activities in Gulf of Mexico waters from the Mexico-Texas border to Key West, Florida, up to one mile into rivers shall be completed, whenever possible, between December 1 and March 31, when sea turtle abundance is lowest throughout Gulf coastal waters. Hopper dredging of Key West channels is covered by the existing September 25, 1997, RBO to the COE's SAD.

2. *Non-hopper Type Dredging*: Pipeline or hydraulic dredges, because they are not known to take turtles, must be used whenever possible between April 1 and November 30 in Gulf of Mexico waters up to one mile into rivers. This should be considered particularly in channels such as those associated with Galveston Bay and Mississippi River - Gulf Outlet (MR-GO), where lethal takes of endangered Kemp's ridleys have been documented during summer months, and Aransas Pass, where large numbers of loggerheads may be found during summer months. In the MR-GO, incidental takes and sightings of threatened loggerhead sea turtles have historically been highest during April and October.

3. *Annual Reports*: The annual summary report, discussed below (No. 9), must give a complete explanation of why alternative dredges (dredges other than hopper dredges) were not used for maintenance dredging of channels between April and November.

4. *Observers*: 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 Gulf sturgeon and their remains.

    a. Brazos Santiago Pass east to Key West, Florida: Observer coverage sufficient for 100% monitoring (i.e., two observers) of hopper dredging operations is required aboard the hopper dredges year-round from Brazos Santiago Pass to (not including) Key West, Florida, between April 1 and November 30, and whenever surface water temperatures are 11°C or greater.

b. Observer coverage of hopper dredging of sand mining areas shall ensure 50% monitoring (i.e., one observer).

c. Observers are not required at any time in Mississippi River - Southwest Pass (MR-SWP).

5. *Operational Procedures*: During periods in which hopper dredges are operating and NMFS-approved protected species observers are *not* required (as delineated in No. 4 above), the appropriate COE District must:

a. Advise inspectors, operators, and vessel captains about the prohibitions on taking, harming, or harassing sea turtles.

b. Instruct the captain of the hopper dredge to avoid any turtles and whales encountered while traveling between the dredge site and offshore disposal area, and to immediately contact the COE if sea turtles or whales are seen in the vicinity.

c. Notify NMFS if sea turtles are observed in the dredging area, to coordinate further precautions to avoid impacts to turtles.

d. Notify NMFS immediately by phone **(727/824-5312)**, fax **(727/824-5309)**, or electronic mail **(takereport.nmfsser@noaa.gov)** if a sea turtle or Gulf sturgeon or any other threatened or endangered species is taken by the dredge.

6. *Screening*: When sea turtle observers are required on hopper dredges, 100% inflow screening of dredged material is required and 100% overflow screening is recommended. If conditions prevent 100% inflow screening, inflow screening may be reduced gradually, as further detailed in the following paragraph, but 100% overflow screening is then required.

a. Screen Size: The hopper's inflow screens should have 4-inch by 4-inch screening. If the COE, 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% 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.

c. Exemption - MR-SWP: Screening is not required at any time in MR-SWP.

7. *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.

8. *Sea Turtle Deflecting Draghead*: A state-of-the-art rigid deflector draghead must be used on all hopper dredges in all Gulf of Mexico channels and sand mining sites at all times of the year except that the rigid deflector draghead is not required in MR-SWP at any time of the year.

9. *Dredge Take Reporting*: Observer reports of incidental take by hopper dredges must be faxed or e-mailed to NMFS' Southeast Regional Office **[fax: (727) 824-5309; e-mail: takereport.nmfsser@noaa.gov]** by onboard NMFS-approved protected species observers within 24 hours of any sea turtle, Gulf sturgeon, or other listed species take observed.

   A preliminary report summarizing the results of the hopper dredging and any documented sea turtle or Gulf sturgeon takes must be submitted to NMFS within 30 working days of completion of any 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 (if relocation trawling, the number and species of turtles relocated), screening type (inflow, overflow) utilized, daily water temperatures, name of dredge, names of endangered species observers, percent observer coverage, and any other information the COE deems relevant.

   An annual report (based on fiscal year) must be submitted to NMFS summarizing hopper dredging projects and documented incidental takes.

10. *Sea Turtle and Gulf Sturgeon Strandings*: The COE or its 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, bed-leveler dredging, and relocation trawling 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. Similarly, the COE shall notify NMFS SERO PRD of any Gulf sturgeon 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 completion to NMFS' Southeast Regional Office. Because the deaths of these turtles, if hopper dredge or bed-leveler dredge related, have already been accounted for in NMFS' jeopardy analysis, these strandings will not be counted against the COE's take limit.

11. *Reporting - Strandings*: Each COE District shall provide NMFS' Southeast Regional Office with an annual report detailing incidents, with photographs when available, of stranded sea turtles and Gulf sturgeon that bear indications of draghead impingement or entrainment or any dredge-type interaction. This reporting requirement may be included in the end-of-year report required in Term and Condition No. 9, above.

12. *District Annual Relocation Trawling Report*: Each COE District shall provide NMFS' Southeast Regional Office with end-of-project reports within 30 days of completion of relocation trawling projects, and an annual report summarizing relocation trawling efforts and results within their District. The annual report requirement may be included in the end-of-year report required in Term and Condition No. 9, above.

13. *Conditions Requiring Relocation Trawling*: Handling of sea turtles and Gulf sturgeon captured during relocation trawling in association with hopper dredging projects in Gulf of Mexico navigation channels and sand mining areas shall be conducted by NMFS-approved protected species observers. Relocation trawling shall be undertaken by the COE at all projects where <u>any</u> of the following conditions are met; however, other ongoing projects not meeting these conditions are not required to conduct relocation trawling:

    a. Two or more turtles are taken in a 24-hour period in the project.

    b. Four or more turtles are taken in the project.

    c. 75% of any of the incidental take limits, including per species limits, specified in Section 8.1, has previously been met.

14. *Relocation Trawling Waiver*: For individual projects the affected COE District may request by letter to NMFS a waiver of part or all of the relocation trawling requirements. NMFS will consider these requests and decide favorably if the evidence is compelling.

15. *Relocation Trawling - Annual Take Limits*: This opinion authorizes, without the need for an ESA section 10 permit: the annual (by fiscal year) non-injurious take of 300 sea turtles (of one species or combination of species including Kemp's ridley, loggerhead, green, leatherback, and hawksbill) and 8 Gulf sturgeon, and annual (by fiscal year) lethal or injurious takes of up to 2 sea turtles and 1 Gulf sturgeon, by trawlers conducting relocation trawling, and handling of those captured threatened or endangered species by NMFS-approved protected species observers, in association with all relocation trawling conducted or contracted by the four Gulf of Mexico COE Districts to temporarily reduce or assess the abundance of these listed species during, and in the 0-3 days immediately

preceding, a hopper dredging or bed-leveling project in order to reduce the possibility of lethal hopper dredge or bed-leveler interactions, subject to the following conditions:

a. *Trawl Time*: Trawl tow-time duration shall not exceed 42 minutes (doors in - doors out) and trawl speeds shall not exceed 3.5 knots.

b. *Handling During Trawling*: Sea turtles and Gulf sturgeon captured pursuant to relocation trawling 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 IV).

c. *Captured Turtle and Gulf Sturgeon Holding Conditions*: Turtles and Gulf sturgeon 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 T&C 15-e, below. Captured Gulf sturgeon shall be held in a suitable well-aerated seawater enclosure until they are released, according to the conditions of T&C 15-f, below.

d. *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. When safely possible, all Gulf sturgeon shall be measured (fork length and total length), 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/tissue sampling operations.

   NMFS-approved protected species observers may conduct more invasive scientific procedures (e.g., blood letting, laparoscopies, 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 or Gulf sturgeon 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.

e. *Take and Release Time During Trawling - Turtles*: Turtles shall be kept no longer than 12 hours prior to release and shall be released not less than 3 (three) nautical miles (nmi) from the dredge site. If two or more released turtles are later recaptured, subsequent turtle captures shall be released not less than 5 (five) nmi away. If it can be done safely and without injury to the turtle, turtles may be transferred onto another vessel for transport to the release area to enable the relocation trawler to keep sweeping the dredge site without interruption.

f. *Take and Release Time During Trawling - Gulf Sturgeon*: Gulf sturgeon shall be released immediately after capture, away from the dredge site or into already dredged areas, unless the trawl vessel is equipped with a suitable well-aerated seawater holding tank, container, trough, or pool where a maximum of one fish may be held for not longer than 30 minutes before it must be released or relocated away from the dredge site.

g. *Injuries and Incidental Take Limits*: Any protected species injured or killed during or as a consequence of relocation trawling shall count toward the Gulf-wide limit for injurious or lethal takes during relocation trawling (0-2 sea turtles and 0-1 Gulf sturgeon per fiscal year). Minor skin abrasions resulting from trawl capture are considered non-injurious. Injured sea turtles shall be immediately transported to the nearest sea turtle rehabilitation facility.

h. *Turtle Flipper External 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-type 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.

i. *PIT Tagging:* This opinion serves as the permitting authority for any NMFS-approved protected species observer aboard a relocation trawler to PIT-tag captured sea turtles and Gulf sturgeon. PIT tagging of sea turtles and Gulf sturgeon 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);

Gulf sturgeon PIT tagging must then be performed in accordance with the protocol detailed at the NMFS SERO PRD Web site address: http://sero.nmfs.noaa.gov/pr/protres.htm.

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.

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

k. *PIT-Tag Scanning and Data Submission Requirements*: All sea turtles and Gulf sturgeon 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 Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149. All sea turtle data collected shall be submitted in electronic format within 60 days of project completion to Lisa.Belskis@noaa.gov and Sheryan.Epperly@noaa.gov. Sea turtle external flipper tag and PIT tag data generated and collected by relocation trawlers shall also be submitted to the Cooperative Marine Turtle Tagging Program (CMTTP), on the appropriate CMTTP form, at the University of Florida's Archie Carr Center for Sea Turtle Research.

Gulf sturgeon data (PIT tag scan data and external tagging data) shall be submitted within 60 days of project completion to NOAA, National Marine Fisheries Service, Protected Resources Division, 263 13th Avenue South, St. Petersburg, Florida 33701, or by **fax: (727) 824-5309;** or by **e-mail: takereport.nmfsser@noaa.gov**, Attn: Dr. Stephania Bolden.

l. *Handling Fibropapillomatose Turtles*: NMFS-approved protected species observers are not required to handle or sample 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 either: 1) Clean all equipment that comes in contact with the turtle (tagging equipment, tape measures, etc.) with mild bleach solution, between the processing of each turtle or 2) maintain a separate set of sampling equipment for handling animals displaying fibropapilloma tumors or lesions.

16. *Requirement and Authority to Conduct Tissue Sampling for Genetic 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, and live- or dead-captured Gulf sturgeon, without the need for an ESA section 10 permit.

All live or dead sea turtles and Gulf sturgeon 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 that it has sufficient samples from specific areas across the Gulf of Mexico in order to obtain reliable genetic information on the nesting or sub-population identity of sea turtles and Gulf sturgeon being captured or lethally taken, to improve the effectiveness of future consultations.

Sea turtle tissue samples shall be taken in accordance with NMFS' Southeast Fisheries Science Center's (SEFSC) procedures for sea turtle genetic analyses (Appendix II of this opinion). The COE shall ensure that tissue samples taken during a dredging project are collected and stored properly and mailed within 60 days of the completion of their dredging project to: NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149.

Gulf sturgeon tissue samples (i.e., fin clips or barbel clips) shall be taken in accordance with NMFS SERO's Protected Resources Division's Gulf Sturgeon Tissue Sampling Protocol found at the NMFS SERO PRD Web site address: http://sero.nmfs.noaa.gov/pr/protres.htm. The COE shall ensure that tissue samples taken during a dredging project are collected and stored properly and mailed to SERO PRD (Attn: Dr. Stephania Bolden) within 60 days of the completion of their dredging project.

17. *Hardground Buffer Zones*: All dredging in sand mining areas will be designed to ensure that dredging will not occur within a minimum of 400 feet from any significant hardground areas or bottom structures that serve as attractants to sea turtles for foraging or shelter. NMFS considers (for the purposes of this opinion only) a significant hardground in a project area to be one that, over a horizontal distance of 150 feet, has an average elevation above the sand of 1.5 feet or greater, and has algae growing on it. The COE Districts shall ensure that sand mining sites within their Districts are adequately mapped to enable the dredge to stay at least 400 feet from these areas. If the COE is uncertain as to what constitutes significance, it shall consult with NMFS SERO's Habitat Conservation Division (727-824-5317) and NMFS' Protected Resources Division (727-824-5312) for clarification and guidance. Walls of federally-maintained navigation channels, and jetties and other such man-made structures, are not considered hardgrounds for the purpose of this opinion.

18. *Training - Personnel on Hopper Dredges*: The respective COE Districts 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 each 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.

19. *Dredge Lighting*: From May 1 through October 31, sea turtle nesting and emergence season, all lighting aboard hopper dredges and hopper dredge pumpout barges operating within 3 nmi of sea turtle nesting beaches shall be limited to the minimal lighting necessary to comply with U.S. Coast Guard and/or OSHA requirements. All non-essential lighting on the dredge and pumpout barge shall be minimized through reduction, shielding, lowering, and appropriate placement of lights to minimize illumination of the water to reduce potential disorientation effects on female sea turtles approaching the nesting beaches and sea turtle hatchlings making their way seaward from their natal beaches.

10.0 Conservation Recommendations

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

1. *Channel Conditions and Seasonal Abundance Studies*: Channel-specific studies should be undertaken to identify seasonal relative abundance of sea turtles and Gulf sturgeon within Gulf of Mexico channels. The December 1 through March 31 dredging window and associated observer requirements listed above may be adjusted (after consultation and authorization by NMFS) on a channel-specific basis, if (a) the COE can provide sufficient scientific evidence that sea turtles and Gulf sturgeon are not present or that levels of abundance are extremely low during other months of the year, or (b) the COE can identify seawater temperature regimes that ensure extremely low abundance of sea turtles or Gulf sturgeon in coastal waters, and can monitor water temperatures in a real-time manner. Surveys may indicate that some channels do not support significant turtle populations, and hopper dredging in these channels may be unrestricted on a year-round basis, as in the case of MR-SWP. To date, sea turtle deflector draghead efficiency has not reached the point where seasonal restrictions can be lifted.

2. *Draghead Modifications and Bed Leveling Studies*: The New Orleans, Galveston, Mobile, and Jacksonville Districts should supplement the efforts of SAD and ERDC 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.

3. *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 the COE's Galveston, New Orleans, Mobile, and Jacksonville Districts coordinate with ERDC, SAD, 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 and Gulf sturgeon takes.

4. *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 and Gulf sturgeon takes by hopper dredge. Observation of overflow and inflow screening is only partially effective and provides only partial estimates of total sea turtle and Gulf sturgeon mortality.

   Overflow Screening: The COE should encourage dredging companies to develop or modify existing overflow screening methods on their company's dredge vessels for maximum effectiveness of screening and monitoring. Horizontal overflow screening is preferable to vertical overflow screening because NMFS considers that horizontal overflow screening is significantly more effective at detecting evidence of protected species entrainment than vertical overflow screening.

   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.

5. *Section 10 Research Permits, Relocation Trawling, and Piggy-Back Research*: NMFS recommends that the COE's Galveston, New Orleans, Mobile, and Jacksonville Districts, either singly or combined, apply to NMFS for an ESA section 10 research permit to conduct endangered species research on species incidentally captured during relocation trawling. For example, satellite tagging of captured turtles could enable the COE Districts to gain important knowledge on sea turtle seasonal distribution and presence in navigation channels and sand mining sites 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 Districts with the permit application process. Similarly, NMFS encourages the COE to cooperate with NMFS' scientists, other federal agencies' scientists, and university scientists to make fuller use of turtles and Gulf sturgeon taken pursuant to the authority conferred by this opinion during hopper dredging and relocation trawling, by allowing and encouraging "piggy-back" research projects by duly-permitted individuals or their authorized designees. 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.

6. *Draghead Improvements - Water Ports*: NMFS recommends that the COE's Gulf of Mexico Districts 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 SAD personnel for various draghead modifications to address scenarios where turtles may be entrained during hopper dredging (Dickerson and Clausner 2003). These include: a) an adjustable visor; b) water jets for flaps to prevent plugging and thus reduce the requirement to lift the draghead off the bottom; and c) 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.

7. *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.

8. *Sedimentation Limits to Protect Resources (Hardbottoms/Reefs)*: NMFS recommends water column sediment load deposition rates of no more than 200 $mg/cm^2/day$, averaged over a 7-day period, to protect coral reefs and hard bottom communities from dredging-associated turbidity impacts to listed species foraging habitat.

9. *Boca Grande Pass - Conditions*: If the COE's Jacksonville District decides to renew dredging permits for the Boca Grande Pass, NMFS recommends that the District conduct or sponsor a Gulf sturgeon study, including gillnetting and tagging utilizing ultrasonic and radio transmitters, and mtDNA sampling, to help determine the genetic origins, relative and seasonal abundance, distribution and utilization of estuarine and marine habitat by Gulf sturgeon within Charlotte Harbor estuary and Charlotte Harbor Entrance

Channel, and shall report to NMFS biannually on the progress and final results of said study.

10. *Relocation Trawling - Guidelines*: Within six months of the issuance of this opinion, the COE's Gulf of Mexico Districts, in coordination with COE's SAD, should develop relocation trawling guidelines to ensure safe handling and standardized data gathering techniques for sea turtles and Gulf sturgeon by COE contractors, and forward copies to NMFS' Protected Resources Division.

11. *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.

11.0 Reinitiation of Consultation

Requirements for Reinitiation of Consultation: Reinitiation of formal consultation is required if (a) the amount or extent of taking specified in the incidental take statement is exceeded (any of the specified limits), (b) new information reveals effects of the action that may affect listed species or critical habitat when designated in a manner or to an extent not previously considered, (c) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the opinion, or (d) a new species is listed or critical habitat designated that may be affected by the identified action.

Advance Discussions of Potential Need for Reinitiation: NMFS requests that COE districts initiate discussions with the Southeast Regional Office Protected Resources Division early to identify the potential need for reinitiation of consultation, well in advance of actually exceeding the amount or extent of taking specified in the incidental take statement. NMFS requests notification when a) more than one turtle is taken by a dredge in any 24-hour period; b) four turtles are taken by a dredge during a single project; c) the dredge take reaches 75% of the total take level established for any one species; d) a Gulf sturgeon is taken by a dredge; e) a hawksbill turtle is taken by a dredge; f) a turtle or Gulf sturgeon is injuriously or lethally taken by a relocation trawler; or g) the relocation trawling incidental take limit for turtles or sturgeon is reached. The NMFS Southeast Regional Office will work with the COE to quickly review such incidents, to discuss the need and advisability of further mitigating measures, and to plan for a reinitiation of consultation if it appears that one of the reinitiation triggers is likely to be met.

Dredging/Trawling Operations During Reinitiation of Consultation: Once the need for reinitiation is triggered, the COE is not necessarily required to suspend dredging or relocation trawling operations pending the conclusion of the reinitiated consultation, so long as the continuation of operations (by all districts and all permittees) would not violate section 7(a)(2) or 7(d) of the ESA. In that case, the COE is advised to document its determination that these provisions would not be violated by continuing activities covered by this opinion during the reinitiation period and to notify NMFS of its findings.

Appendix 3:
NMFS Sea Turtle and Smalltooth Sawfish Construction Conditions,
March 2006.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

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
O:\forms\Sea Turtle and Smalltooth Sawfish Construction Conditions.doc