**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
NATIONAL MARINE FISHERIES SERVICE
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F/SER31:KBD

OCT - 3 2012

Mr. James F. Bennett
Chief, Division of Environmental Assessment
Bureau of Ocean Energy Management
381 Elden Street
Herndon, VA 20170

Re: Post-Hurricane Irene Beach Nourishment Project, Carteret County, NC

Dear Mr. Bennett:

Enclosed is the National Marine Fisheries Service's (NMFS) biological opinion (opinion) to the Bureau of Ocean Energy Management (BOEM) analyzing BOEM's proposed use of beach quality sand resources from the Morehead City Ocean Dredged Materials Disposal Site located in federal waters off Carteret County, North Carolina. BOEM will authorize the use of sand from the Outer Continental Shelf (OCS) site for the project under the OCS Lands Act. The sand will be used for the Post-Hurricane Irene Beach Renourishment Project in Carteret County, North Carolina, along Bogue Banks beach within the towns of Emerald Isle and Pine Knoll Shores.

The opinion analyzes the project's effects in federal waters on North Atlantic right whales, humpback whales, Atlantic sturgeon, shortnose sturgeon, and swimming sea turtles in accordance with Section 7 of the Endangered Species Act of 1973, and is based on information provided in BOEM's letter dated March 16, 2012; the biological assessment submitted with the consultation package; and information from previous NMFS consultations. It is our opinion that the action, as proposed, is likely to adversely affect loggerhead and green sea turtles, but is not likely to jeopardize their continued existence. The opinion authorizes a limited amount of incidental take of loggerhead and green sea turtles by hopper dredging and relocation trawling.

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 Kay Davy, consultation biologist, by e-mail at Kay.Davy@noaa.gov or 954-356-6791.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure

File: 1514-22.J
Ref: F/SER/2012/01054

cc: Jennifer Culbertson, BOEM
David L. Timpy, COE
William Straw, FEMA

Endangered Species Act - Section 7 Consultation
Biological Opinion

| | |
|---|---|
| Action Agency: | Bureau of Ocean Energy Management |
| Activity: | Post-Hurricane Irene Beach Renourishment Project in Carteret County, North Carolina (Consultation Number F/SER/2012/01054) |
| 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<br>NMFS, Southeast Regional Office<br>St. Petersburg, Florida |
| Date Issued: | Oct. 3, 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 offshore (federal waters) sand mining for beach restoration/nourishment activities in Carteret County, North Carolina, by the Bureau of Ocean Energy Management (BOEM), 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*), North Atlantic right whales (*Balaena glacialis*), humpback whales (*Megaptera novaeangliae),* Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) and shortnose sturgeon (*Acipenser brevirostrum*), 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 NMFS. Consultations are concluded after NMFS' 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.

This opinion is based on information provided by BOEM, previous NMFS opinions on hopper dredging, and dredging, and sea turtle reports submitted by the U.S. Army Corps of Engineers (USACE) and/or maintained on their Sea Turtle Data Warehouse Web site (http://el.erdc.usace.army.mil/seaturtles/index.cfm).

## 1 Consultation History

On March 16, 2012, NMFS received a request from BOEM for formal ESA consultation on BOEM's proposed leasing of federal sand resources for beach renourishment purposes at the towns of Emerald Isle and Pine Knoll Shores in Carteret County, North Carolina. The project applicant is Carteret County. BOEM determined that hopper dredging of offshore sand to carry out the project could adversely affect federally-listed sea turtles and sturgeon under NMFS' purview. After reviewing the project description, NMFS determined that a hopper dredge(s) would be used to mine sand from federal water "sand borrow areas" under the permitting/leasing authority of BOEM and that potential interactions with protected species during hopper dredging could occur in federal waters. NMFS initiated formal consultation on April 19, 2012. During the review of project documents, NMFS determined that BOEM's proposed dredging in federal

waters is not authorized by NMFS' 1997 regional biological opinion ("SARBO") issued to USACE South Atlantic Division for hopper dredging in state waters and that BOEM had not indicated if they intended to "piggy-back" on the 1997 SARBO with permission from the USACE. Therefore, NMFS asked BOEM if they intended to ask the USACE for permission to use the 1997 SARBO. On June 25, 2012, after consulting with USACE, BOEM replied that where the USACE is not the lead agency (because the project is not being completed through the USACE's Civil Works program), the USACE has been unable to apply the 1997 SARBO. In this case, the project is to be completed by Carteret County. Since the County is not using a state sand borrow site (all sand is coming from federal waters), the USACE does not have any jurisdiction over the dredging portion of the project. The USACE's only involvement is issuing a permit for sand placement on the beach (USACE permit number SAW-2012-00026). Thus, BOEM would need its own "stand-alone" biological opinion, and Incidental Take Statement to authorize potential protected species interactions occurring in federal waters. On September 4, 2012, NMFS received additional information from the applicant's consultant stating that the County intended to require relocation trawling and that the trawling should be included as a proactive conservation measure in the proposed project. In an e-mail dated September 7, 2012, the consultant provided further clarification stating that the onset of relocation trawling would be triggered by the take of at least one sea turtle.

Prior consultations in/near the project area included a Biological Assessment dated July 5, 2001, that was submitted to NMFS and USFWS as a component of the ESA Section 7 consultation process for the Bogue Banks Beach Restoration Project (USACE permit number SAW-2000-00362). During the review of the document in 2001, NMFS responded that adherence to the conservation measures contained in the 1997 SARBO would be sufficient to minimize impacts on listed species. In response to NMFS, the following conservation measures were adopted and included as conditions of the project permit: compliance with the 1997 SARBO, adherence to a 16 November–30 April environmental construction window, measures to ensure compatibility of the fill material, three years of post-project compaction, and escarpment monitoring. During pre-project agency coordination for the 2004 Post-Isabel Sand Replacement Project, NMFS responded that consultation was not required provided all conditions of the 1997 SARBO were implemented during the project. During pre-project agency coordination for the 2007 Post-Ophelia Sand Replacement Project, NMFS again responded that consultation was not required provided all conditions of the 1997 SARBO were implemented. Since this project is proposing to use a borrow area within federal waters that is not authorized by the 1997 SARBO, unlike these previous projects, new consultation must be conducted for the dredging operations.

# 2 Description of the Action

## 2.1 Proposed Action

The proposed project would place a maximum of 992,000 cubic yards of sand on Bogue Banks along 7.1 miles of beaches in the towns of Emerald Isle and Pine Knoll Shores between the existing toe of the fore-dune out to an approximate elevation of -8 feet NAVD with varying berm restoration widths and seaward slopes of 1:20 (Figures 1 and 2). Suitable sand sources within the Morehead City Ocean Dredged Material Disposal Site (ODMDS) have been identified in accordance with *State of North Carolina Technical Standards for Beach Fill Projects* (15A

North Carolina Administrative Code (NCAC) 07H.0312). The proposed project would utilize a hopper dredge to excavate sand from the ODMDS. Once fully loaded, the hopper dredge would travel from the ODMDS to a nearshore pump-out station along the target beach. Distances traveled would range from 7 to 21 miles with three to four round-trips anticipated daily. The dredge would connect to a submerged discharge pipeline at the pump-out stations located offshore in approximately 30 feet of water and sediment from the hopper dredge would be pumped through the pipeline onto the recipient beach. The position of the nearshore pump-out station and discharge pipeline would shift incrementally as construction progresses along the beach. The project would require approximately two to three months for completion and would adhere to a construction window of November 16 – March 31 to avoid the sea turtle nesting and hatching season. According to the applicant's consultant (Dial Cordy and Associates, Inc.), relocation trawling would be initiated with the take of at least one sea turtle and would be conducted from November 16 through December 31 and March 1 through March 31. They have requested an exemption from relocation trawling during the months of January and February since no sea turtle takes have ever occurred in the project area during hopper dredging conducted in January and February.

Figure 1. Project location map

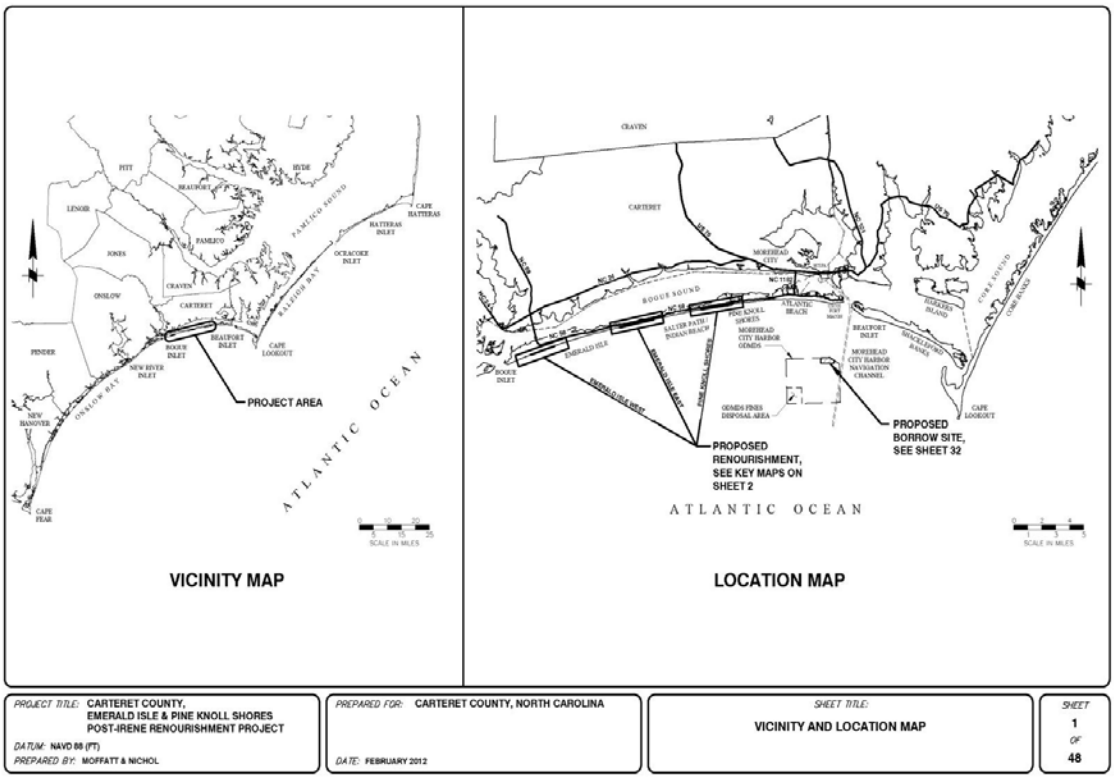
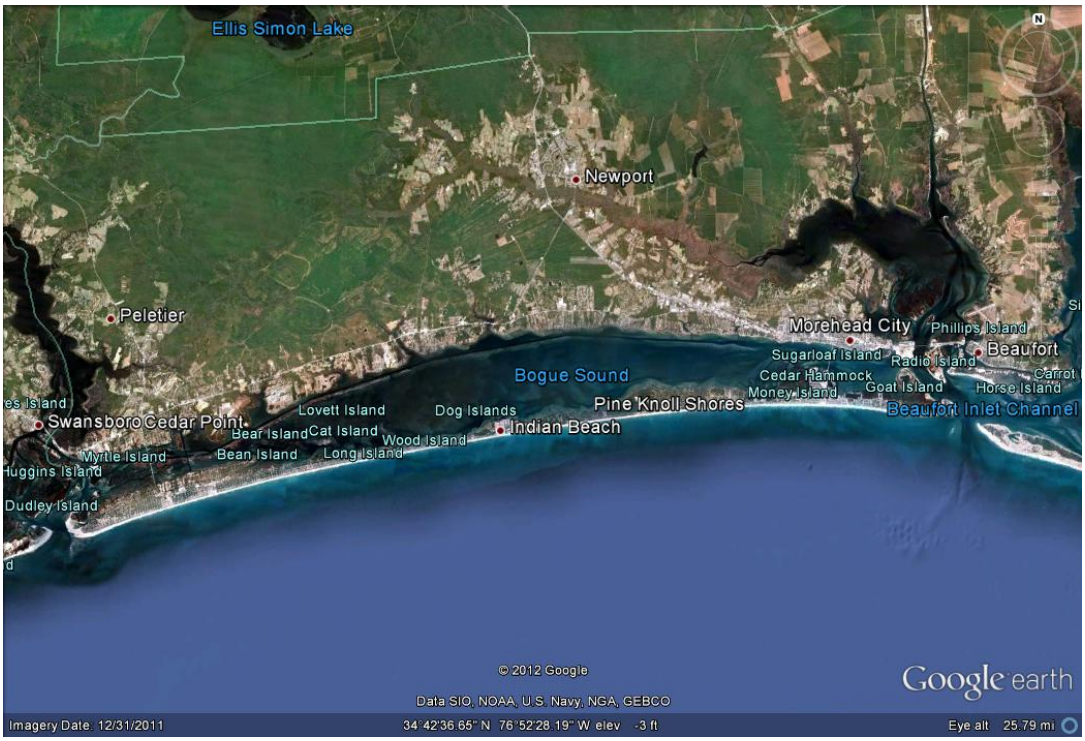


Figure 2. Aerial of project area




Authorization to permit activities in federal waters off the southeast coast on the Outer Continental Shelf (OCS), such as the proposed offshore sand mining, resides solely with BOEM. BOEM will authorize the use of sand from the offshore site for the project under the OCS Lands Act. Sand from the proposed ODMDS has been used during previous renourishment projects on Bogue Banks, including the 2004 Post-Isabel and the 2007 Post-Ophelia sand replenishment projects that placed sand on adjacent beaches. The project will retain compliance with the Federal Emergency Management Agency (FEMA) criteria for managing engineered beaches. FEMA will be a funding sponsor of the proposed project.

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 USACE, are already discussed and analyzed and accounted for in the SARBO. The USACE South Atlantic Division (SAD) requested reinitiation on the existing 1997 SARBO on April 30, 2007. On July 12, 2012, the USACE met with NMFS in St. Petersburg to discuss the SARBO on the continued hopper dredging of channels and borrow areas in the southeastern United States. BOEM permitting of dredging in federal waters is being considered during reinitiation. Until a new SARBO is complete, the existing SARBO covers state water dredging and nourishment activities and we will include them as interrelated activities to the proposed action by BOEM. The Effects of the Action section and Jeopardy Analysis section of this opinion account for and analyze interactions that may result from the proposed action in federal waters, according to the reasonable and prudent measures (and implementing terms and conditions) of this opinion (Section 9), and authorizes the interactions with listed species that are expected to occur from activities in federal waters.

*Harm Avoidance and Minimization Measures that will be Implemented by BOEM in Federal Waters*

BOEM has proposed the following Harm Avoidance Measures:

1. Dredges would likely operate at speeds of two to three knots during dredging operations. During transit between the borrow area and pump-out sites, dredges would adhere to a speed limit of ten knots or less.

2. During daylight hours (dawn to dusk), one NMFS-approved endangered species observer with at sea large whale identification experience would be onboard the dredge to conduct observations for large whales. If a right whale is sighted within 500 yards during dredging operations, operations will cease until the observers are confident that the whale has left the area. If a whale is sighted during transit, the crew would reduce speed and alter course as necessary to maintain a distance of 500 yards between the vessel and the whale. All whale sightings would be documented and reported to NMFS.

3. All beach fill material would comply with the State of North Carolina Technical Standards for Beach Fill Projects (15A NCAC 07H .0312). The Technical Standards require the characterization of sediments from the recipient beach and the proposed borrow sites. Sediment characteristics that are considered include percent weight of fine-grained sediment, percent weight of granular sediment, percent weight of gravel, and percent weight of calcium carbonate. Results of the characterization studies are submitted to the North Carolina Division of Coastal Management (NCDCM), which ultimately determines the suitability of sediments from the proposed, borrow site. Daily monitoring of beach nourishment activities would be conducted to further ensure the compatibility of the beach fill material. Visual monitoring of the fill material would be conducted at the dredge pipe outfall before it is redistributed along the beach. If any incompatible fill material is detected, the contractor will cease operations and immediately contact the Wilmington District Regulatory Branch and NCDCM to determine the appropriate course of corrective action.

4. The proposed dredging window (16 November - 31 March) would coincide with periods of low sea turtle abundance. As previously described, multiple studies have shown that sea turtles avoid waters where sea surface temperatures are below 11°C. The presence of sea turtles in nearshore and inshore waters is generally restricted to the months of April through December. Adherence to the proposed window would reduce the likelihood of incidental take during dredging operations.

5. Use of the rigid draghead deflector would be required during all hopper dredging operations. All dredging contracts would require the proper installation and operation of the rigid draghead deflector. Entrainment rates are dramatically reduced when rigid deflectors are used and deployed correctly.

6. Dredging contracts would require 100 percent inflow screening. NMFS-approved endangered species observers would provide 100 percent (24 hours/day) monitoring of inflow screens, dragheads, and hoppers. During active dredging when dragheads are submerged, NMFS-approved endangered species observers would continuously monitor (24 hours) the inflow screening for sturgeon, turtles and/or parts of these animals. At the completion of each load cycle, dragheads would be physically inspected as they are lifted from the sea surface and placed on the saddle to account for sturgeon or sea turtles that may be impinged within the draghead. The dredge contractor would install lighting sufficient to illuminate the screens and draghead during nighttime hours. Endangered species observers would work in 12- or 24-hour shifts, such that one observer would be onboard the dredge at all times.

7. In addition to monitoring inflow screening, dragheads, and hoppers. During daylight hours the endangered species observer would survey for the presence of endangered species during transit to and from the work zones.

8. The Silent Inspector[1] automated dredge monitoring system would be required on all hopper dredges. Data generated by the Silent Inspector will be used to monitor contractor compliance with hopper dredge operating requirements, including proper operation of the draghead.

9. Relocation trawling would be conducted from November 16 through December 31 and March 1 through March 31. According to BOEM's consultant, the results of previous dredging events indicated zero take of sea turtles occurred during the months of January and February; therefore, relocation trawling should not be needed during January and February.

## 2.2 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 includes sand placement along 7.1 miles in three distinct locations of Carteret County's Bogue Banks shoreline: (1) western Emerald Isle between survey transects 9-16 (approximately 265,000 cubic yards along 2.0 miles); (2) eastern Emerald Isle between survey transects 35-46 (approximately 410,000 cubic yards along 2.6 miles); and (3) Pine Knoll Shores between survey transects 61-70 (approximately 317,000 cubic yards along 2.5 miles). The western boundary is approximately two miles east of Bogue Inlet, and the eastern boundary is approximately eight miles west of Beaufort Inlet.

The Morehead City ODMDS is a United States Environmental Protection Agency (USEPA) designated dredged material disposal site. The site is utilized by the USACE Wilmington District as a disposal area for material dredged during maintenance of the Morehead City Harbor

[1] The Silent Inspector system was developed for monitoring hopper dredge operations. The system collects and records measurements from shipboard sensors, calculates the dredging activities being performed, and displays the information through standard reports and graphical data displays. Recorded data are also automatically backed up and later archived to allow transfer of the data to other locations.

navigation channels. The ODMDS occupies an area of approximately eight square nautical miles (nm) offshore of eastern Bogue Banks. The inner boundary of the ODMDS is just over three nm from shore, and the outer boundary is approximately 11 nm from shore. Depths range from approximately -31 to -55 feet mean low water.

Once fully loaded, the hopper dredge would travel from the ODMDS to a nearshore pump-out station along the target beach. The position of the nearshore pump-out station and discharge pipeline would shift incrementally as construction progresses along the beach.

# 3 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 Literature Cited section). The following listed species under the jurisdiction of NMFS are known to occur near the action area:

| Common Name | Scientific Name | Status |
|---|---|---|
| Sea Turtles | | |
| Green sea turtle | *Chelonia mydas*[2] | E/T |
| Kemp's ridley sea turtle | *Lepidochelys kempii* | E |
| Leatherback sea turtle | *Dermochelys coriacea* | E |
| Hawksbill sea turtle | *Eretmochelys imbricata* | E |
| Loggerhead sea turtle | *Caretta caretta*[3] | T |
| Fish | | |
| Shortnose sturgeon | *Acipenser brevirostrum* | E |
| Atlantic sturgeon | *Acipenser oxyrinchus oxyrinchus* | E |
| Marine Mammals | | |
| North Atlantic right whale | *Eubalaena glacialis* | E |
| Humpback whale | *Megaptera novaeangliae* | E |
| Fin whale | *Balaenoptera physalus* | E |
| Blue whale | *Balaenoptera musculus* | E |
| Sei whale | *Balaenoptera borealis* | E |
| Sperm whale | *Physeter macrocephalus* | E |

## 3.1 Species Not Likely to be Adversely Affected

### 3.1.1 Marine Mammals

NMFS determined that potential effects on North Atlantic right whales, blue, fin, sei, and humpback whales from the proposed action are limited to the following: injury from potential interactions with construction equipment (e.g., a dredge vessel striking a whale) and temporary avoidance of the area during construction (i.e., dredging/renourishment) operations. It is

[2] Green turtles in U.S. waters are listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are listed as endangered.
[3] Northwest Atlantic Ocean, Distinct Population Segment (U.S.DPS).

assumed that migrating right whales may be present in the vicinity of the Morehead City ODMDS from October through April as they move back and forth between the summer feeding/nursery areas and winter calving sites. However, NMFS believes the proposed project is not likely to adversely affect North Atlantic right whales, blue, fin, sei, and humpback whales. The contractors will be required to abide by the 10-knot speed restriction during North Atlantic right whale calving season and follow NMFS' *Vessel Strike Avoidance and Reporting Guidelines.* Observers will also be on board. With implementation of these mandatory conservation measures, NMFS believes that the likelihood of blue, fin, sei, humpback and North Atlantic right whales being affected by the proposed action is discountable. As a result, these species will not be discussed further in this opinion.

### 3.1.2 Sturgeon

Shortnose sturgeon were thought to be extirpated from North Carolina waters until an individual was captured in the Brunswick River in 1987 (Ross et al. 1988). Subsequent gillnet studies (1989-1993) resulted in the capture of five shortnose sturgeon, confirming the presence of a small population in the lower Cape Fear River (Moser and Ross 1995). The shortnose sturgeon is not known to occur in the vicinity of the project area. Based on its restriction primarily to the portions of rivers above the freshwater-saltwater interface, its occurrence within project area waters (i.e., Atlantic Ocean) is considered unlikely.

Atlantic sturgeons were historically abundant in most North Carolina coastal rivers and estuaries. Populations are currently known from the Roanoke, Tar-Pamlico, Neuse, and Cape Fear River systems. Spawning is known to occur in the Roanoke, Tar-Pamlico, and Cape Fear River systems; and possibly in the Neuse River (Atlantic Sturgeon Status Review Team 2007). Laney et al. (2007) analyzed Atlantic sturgeon incidental capture data from winter tagging cruises off the North Carolina and Virginia coasts. Cruises conducted in nearshore ocean waters from Cape Lookout, North Carolina, to Cape Charles, Virginia, captured 146 Atlantic sturgeons between 1988 and 2006. Captures typically occurred over sand substrate in nearshore waters that were less than 59 feet deep. Laney et al. concluded that shallow nearshore waters off North Carolina represent a winter (January-February) aggregation site and an important area of winter habitat for Atlantic sturgeon.

Between 1990 and 2007, dredging operations along the North Atlantic Coast and South Atlantic Coast resulted in the take of 11 Atlantic sturgeon and 11 shortnose sturgeon. All of the shortnose sturgeon takes occurred in rivers along the North Atlantic coast (Delaware River and Kennebec River). Shortnose sturgeon were taken by cutterhead (5), hopper (5), and clamshell (1) dredges. Atlantic sturgeon takes included two along the North Atlantic Coast and nine along the South Atlantic Coast. During the 17 year period, Atlantic sturgeons were taken by hopper (9) and clamshell (2) dredges. No sturgeon were taken in the vicinity of the Morehead City Harbor during this period (USACE 2008). Since no sturgeon have been taken in the project area during previous hopper dredging, NMFS believes that the likelihood of Atlantic sturgeon or shortnose sturgeon being affected by the proposed action is discountable. As a result, these species will not be discussed further in this opinion.

### 3.1.3 Sea Turtles

NMFS has analyzed the routes of potential effects on five species of sea turtles (loggerhead, Kemp's ridley, leatherback, hawksbill, and green) from the proposed action. Responsibility for ESA consultation on the effects related to failure to nest (i.e., "false crawls") and/or loss of nests and nesting habitat are the purview of the U.S. Fish and Wildlife Service (USFWS) and will not be discussed in this biological opinion. We have determined the potential routes of effects to sea turtles in the marine environment include injury or death from potential interactions with and operation of hopper dredge suction dragheads, relocation trawlers, pipeline, and avoidance of the area during construction operations due to disturbance caused by construction, lighting, and beach nourishment on the shoreline. Of these, only interactions with hopper dredges and relocation trawlers have the potential for adverse effects and only for certain turtle species, as discussed below and in the Effects of the Action section.

Leatherback sea turtles tend to be open ocean foragers and are uncommon in shallow nearshore waters, except during nesting season (NMFS and USFWS 2007d). Leatherback sea turtles undertake extensive migrations between northern foraging grounds and tropical and subtropical nesting beaches. Since leatherback sea turtles are not likely to be found in the action area, NMFS believes that the likelihood of leatherback sea turtles being adversely affected by the proposed project is discountable.

Hawksbill sea turtles are also rare in the nearshore waters off of North Carolina. Hawksbill sea turtles are very rare in North Carolina waters, and they rarely enter inshore waters (Epperly et al. 1995a). A total of nine hawksbill stranding incidents were reported along North Carolina beaches between 1998 and 2009 (www.seaturtle.org 2011). Juveniles and adults are most commonly associated with coral reef habitats. However, additional habitats may include other hardbottom habitats, seagrass beds, algal beds, mangrove bays and creeks, or mud flats. These habitat types are not found in the action area; therefore, the potential for impacts to hawksbill sea turtles is considered discountable.

Kemp’s ridley sea turtles occur primarily in coastal waters of the Gulf of Mexico and the western North Atlantic Ocean. Nesting is limited primarily to the northeastern coast of Mexico, although rare nesting events have been recorded from the southeastern United States. Kemp’s ridley sea turtle nesting is extremely rare in North Carolina, with only five nesting records for the state. Kemp’s ridleys move inshore in North Carolina during the spring and disperse throughout the sounds during the summer. They move offshore during the late fall and early winter (NMFS and USFWS 2007b). No Kemp’s ridley sea turtles have been encountered during the past twenty years of dredging events occurring in the Morehead City Harbor, which is adjacent to the project site.

Based on the above information, and because the project will comply with NMFS' March 23, 2006, *Sea Turtle and Smalltooth Sawfish Construction Conditions*, which will reduce the potential for interactions with sea turtles, we believe the proposed project may affect, but is not likely to adversely affect leatherback, hawksbill, and Kemp’s ridley sea turtles. Therefore, these species will not be discussed further in the document.

We believe the project is likely to adversely affect loggerhead and green sea turtles, as described below. The proposed action includes the use of hopper dredging, which increases the potential for injury and/or death to occur to sea turtles. Based on the best available dredging event data from the USACE's website, (http://el.erdc.usace.army.mil/seaturtles/info.cfm?Type=District&Code=SAW), which provides the amount of dredged material per event along with any occurrence of sea turtle takes, we believe only loggerhead sea turtles are likely to be adversely affected by hopper dredging in the action area. However, both species may be adversely affected by the proposed relocation trawling.

## 3.2 Species Likely to be Adversely Affected

NMFS believes the proposed action is likely to adversely affect loggerhead and green sea turtles. The status of these species is discussed in the following sections. Species discussions in this section will provide background information on each species. Discussions of sea turtles will focus primarily on the Atlantic Ocean populations of these species since these are the populations that may be affected by the proposed action. However, because green sea turtles are listed globally, we also discuss their worldwide status. The following sub-sections are synopses of the best available information on the life history, distribution, population trends, and current status of the two species of sea turtles that are likely to be adversely affected by one or more components of the proposed action.

### 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 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).

#### 3.2.1.2 Population Dynamics and Status

Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The five-year status review for the species identified eight geographic areas considered to be primary sites for green sea turtle nesting in the Atlantic/Caribbean and reviewed the trend in nest count data for each (NMFS and USFWS 2007a). These 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.

#### 3.2.1.3 Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of green sea turtles for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U.S. jurisdiction, where exploitation is still a threat. 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, and oil spills. In 2010, there was a massive release of oil in the Gulf of Mexico at British Petroleum's Deepwater Horizon well. 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 takes of green turtles.

There is also the increasing threat from green sea turtle fibropapillomatosis disease. Presently, this disease is cosmopolitan and has been found to affect large numbers of animals in some areas, including Hawaii and Florida (Herbst 1994, Jacobson 1990, Jacobson et al. 1991). 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 from climate change 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 from temperature changes (NMFS and USFWS 2007). 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, White et al. 1993), (Fish, Cote et al. 2005), (Baker, Littnan 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, Baker et al. 2006), (Baker, Littnan 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 strong positive trend since establishment of index beaches in Florida in 1989.

### 3.2.2 Northwest Atlantic Ocean DPS of the Loggerhead Sea Turtle

NMFS and USFWS published a final rule listing nine DPSs of loggerhead sea turtles as threatened or endangered (76 FR 58,868, September 22, 2011; effective October 24, 2011). The DPSs established by this rule include: (1) Northwest Atlantic Ocean (threatened); (2) Northeast Atlantic Ocean (endangered); (3) South Atlantic Ocean (threatened); (4) Mediterranean Sea (endangered); (5) North Pacific Ocean (endangered); (6) South Pacific Ocean (endangered); (7) North Indian Ocean (endangered); (8) Southeast Indo-Pacific Ocean (endangered); and (9) Southwest Indian Ocean (threatened). The Northwest Atlantic DPS (NWA DPS) is the only one that occurs within the action area and therefore is the only one to be considered in this opinion.

Within the NWA DPS, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. Previous Section 7 analyses have recognized at least five Western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29ºN; (2) a South Florida nesting subpopulation, occurring from 29°N on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the Eastern Yucatán Peninsula, Mexico (Márquez M 1990), (TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS and SEFSC 2001). The recovery plan for the NWA population of loggerhead sea turtles concluded, based on recent advances in genetic analyses, that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula and that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are: (1) the Northern Recovery Unit (Florida/Georgia border north through southern Virginia); (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida); (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida); (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas); and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 2008). The recovery plan concluded that all recovery units are essential to the recovery of the species. Although the recovery plan was written prior to the listing of the NWA DPS, the recovery units for what was then termed the Northwest Atlantic population apply to the NWA DPS.

#### 3.2.2.1 Life History and Distribution

Past literature gave an estimated age at maturity of 21-35 years (Frazer and Ehrhart 1985; Frazer, Limpus 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 and SEFSC (2001) estimated ages of maturity ranging from 20-38 years and benthic immature stage lasting from 14-32 years.

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

Tagging studies have shown loggerheads that have entered the benthic environment undertake routine migrations along the coast that are limited by seasonal water temperatures. Loggerhead sea turtles occur year-round in offshore waters off North Carolina where water temperature is influenced by the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to immigrate to North Carolina inshore waters (e.g., Pamlico and Core Sounds) and also move up the coast (Epperly 1995; Epperly, Braun et al. 1995; Epperly, Braun et al. 1995), 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 1995; Epperly, Braun et al. 1995; Epperly, Braun et al. 1995). Loggerhead sea turtles are year-round residents of central and southern Florida.

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd and U.S. Fish and Wildlife Service. 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, Solomon et al. 2006), (Hawkes, Broderick 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, Broderick 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 (Hawkes, Broderick et al. 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.

#### 3.2.2.2 Population Dynamics and Status

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

Numbers of nests and nesting females can vary widely from year to year. However, nesting beach surveys can provide a reliable assessment of trends in the adult female population, due to the strong nest site fidelity of females turtles, as long as such studies are sufficiently long and effort and methods are standardized (see, e.g., (NMFS and USFWS 2008), (Meylan 1982). NMFS and USFWS (2008) concluded that the lack of change in two important demographic parameters of loggerheads, remigration interval and clutch frequency, indicate that time series on numbers of nests can provide reliable information on trends in the female population. Recent analysis of available data for the Peninsular Florida Recovery Unit has led to the conclusion that the observed decline in nesting for that unit over the last several years can best be explained by an actual decline in the number of adult female loggerheads in the population (Witherington, Kubilis 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 2,183, with an increase to 3,141 in 2010. Georgia beach surveys located a total of 1,648 nests in 2008. This number surpassed the previous statewide record of 1,504 nests in 2003. In 2009, the number of nests declined to 998, and in 2010, a new statewide record was established with 1,760 loggerhead nests. 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 and SEFSC 2001). However, research conducted over a limited time frame has found opposing sex ratios (Wyneken, Blair 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 (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, Kubilis 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 Florida index nesting number is the largest since 2000. With the addition of data through 2010, the nesting trend for the proposed NWA DPS of loggerheads became only slightly negative and not statistically different from zero (no trend) (NMFS and USFWS 2010). Nesting at the index nesting beaches in 2011 declined from 2010, but was still the second highest since 2001, at 43,595 nests (FWRI nesting database).

The remaining three recovery units—Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU)—are much smaller nesting assemblages but still considered essential to the continued existence of the species. Nesting surveys for the DTRU are conducted as part of Florida's statewide survey program. Survey effort 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, Redfoot et al. 2007), (M. Bresette, pers. comm. regarding captures at the St. Lucie Power Plant, SCDNR unpublished SEAMAP-SA data), (Epperly, Braun-McNeill et al. 2007). Ehrhart, Redfoot 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, Braun-McNeill 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, Byrd 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, Bolten 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 U.S. may be due to increased abundance of the largest Stage III individuals (oceanic/neritic juveniles, historically referred to as small benthic juveniles), which could indicate a relatively large cohort that will recruit to maturity in the near future. However, such an increase in adults may be temporary, as in-water studies throughout the eastern U.S. 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 (TEWG 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. 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.

The results of one set of model runs suggest that the western North Atlantic population (using data up through 2008) 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, Kubilis 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).

#### 3.2.2.3 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 2007). 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, Leone-Kabler et al. 1994). Also, many nests were destroyed during the 2004 and 2005 hurricane seasons. In August 2011, Hurricane Irene side-swiped the U.S. Atlantic sea turtle nesting beaches prior to making landfall farther north. Impacts to sea turtle nests and nesting beaches varied from minor to hundreds of nests and the loss of extensive

nesting habitat on the various beaches. The damage to turtle nesting was somewhat mitigated by the storm's occurrence late in the nesting season, as many nests had already hatched and the hatchlings had already left the beach. Although no specific information is available to determine the long-term population impacts of Hurricane Irene, the impact is not expected to be significant.

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 (Mendonça and Ehrhart 1982), (Ehrhart 1989) and Texas inshore waters (Hildebrand 1982, Shaver 1990).

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. At this time an assessment of total direct impact to sea turtles from the Deepwater Horizon spill has not been determined and 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 also 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, Mas et al. 1995), (Bolten, Bjorndal 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 taken by fisheries vary significantly, depending on the location and season of the fishery, and size-selectivity resulting from gear characteristics. Therefore, it is possible for fisheries that interact with fewer, more reproductively valuable turtles to have a greater detrimental effect on the population than one that takes greater numbers of less reproductively valuable turtles if the fishery removes a higher overall reproductive value from the population (Wallace, Heppell 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, Dutton 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.

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 2007). 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 2007). 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, Broderick et al. 2007).

Warmer sea surface temperatures have been correlated with an earlier onset of loggerhead nesting in the spring (Weishampel, Bagley et al. 2004; Hawkes, Broderick et al. 2007), as well as short inter-nesting intervals (Hays, Broderick et al. 2002) and shorter nesting season (Pike, Antworth 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 sources of anthropogenic mortality on loggerheads.

#### 3.2.2.4 Summary of Status for Loggerhead Sea Turtles

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, and together comprise the NWA DPS. Using the best

scientific information available, no long-term data suggest any of the loggerhead subpopulations throughout the entire North Atlantic were 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, Dutton et al. 2009). However, with the recent increase in nesting, data through 2010 changes the trend for the PFRU from negative to no trend (slightly negative but not statistically significant) (NMFS and USFWS 2010). Nesting at the index nesting beaches for the PFRU in 2011 declined from 2010, but was still the second highest since 2001, at 43,595 nests (FWRI nesting database). Because of its size, the PFRU may be critical to the survival of the species in the Atlantic Ocean.

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

## 4 Environmental Baseline

This section 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. It does not include the effects of the action under review in the consultation.

By regulation, environmental baselines for biological opinions include the past and present impacts of all state, federal, or private actions and other human activities in the action area. We identify the anticipated impacts of all proposed federal projects in the specific action area of the consultation at issue, that have already undergone formal or early Section 7 consultation as well as the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

Focusing on the impacts of the activities in the action area specifically, allows us to assess the prior experience and state (or condition) of the endangered and threatened individuals, and areas of designated critical habitat that occur in an action area, and that will be exposed to effects from the action under consultation. This is important because, in some phenotypic states or life history stages, listed individuals will commonly exhibit, or be more susceptible to, adverse responses to stressors than they would be in other states, stages, or areas within their distributions. The same is true for localized populations of endangered and threatened species: the consequences of changes in the fitness or performance of individuals on a population's status depends on the prior state of the population. Designated critical habitat is not different: under some ecological conditions, the physical and biotic features of critical habitat will exhibit responses that they would not exhibit in other conditions.

## 4.1 Status of Loggerhead and Green Sea Turtles within the Action Area

Loggerhead and green sea turtles are located in the nearshore Atlantic Ocean and may be affected by the proposed action. Both of these species are migratory, traveling for forage grounds or reproduction purposes. The nearshore and inshore waters of the Atlantic Ocean may be used by these sea turtles as post-hatchling developmental habitat or foraging habitat. Loggerhead and green sea turtles use the beaches of North Carolina for nesting. NMFS believes that no individual sea turtles are likely to be permanent residents of the action area, although some individuals may be present at any given time. These same individuals will migrate into offshore waters, as well as other areas of the Gulf of Mexico, Caribbean Sea, and North Atlantic Ocean at certain times of the year, and thus may be impacted by activities occurring there; therefore, these species' statuses in the action area are considered to be the same as their range-wide statuses and supported by the species accounts in Section 3.0. 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.

## 4.2 Factors Affecting Sea Turtles within the Action Area

As stated in Section 2.0 (Action Area), the action area ranges from the immediate offshore area of Bogue Banks beach seaward to the Morehead City ODMDS borrow area. Numerous activities have been identified as threats and may affect sea turtles with the following analysis examining actions that may affect these species' environment within the action area.

### 4.2.1 Federal Actions

In recent years, NMFS has undertaken several ESA Section 7 consultations to address the effects of federally-permitted fisheries and other federal actions on threatened and endangered species. Each of those consultations sought to develop ways of reducing the probability of adverse effects of the action on sea turtles. Similarly, recovery actions NMFS has undertaken under the ESA are addressing the problem of interactions with sea turtles by the fishing and oil and gas industries, vessel operations, and other activities such as USACE dredging operations.

#### 4.2.1.1 Fisheries

Adverse effects on threatened and endangered species from several types of fishing gear occur in the Atlantic Ocean. Efforts to reduce the adverse effects of commercial fisheries are addressed through the ESA Section 7 process. Trawl, hook-and-line, gillnet, and cast net gear fisheries have all been documented as interacting with sea turtles. For each 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 NMFS has determined are likely to adversely affect threatened and endangered species (including sea turtles): coastal migratory pelagic fishery, Southeast shrimp trawl, and Highly Migratory Species Atlantic shark fisheries. An Incidental Take Statement (ITS) has been issued for interactions with sea turtles in each of these fisheries.

NMFS completed a Section 7 consultation on the continued authorization of the coastal migratory pelagic fishery in the South Atlantic (NMFS 2007c) where hook-and-line, gillnet, and cast net gears are used. The recreational sector uses hook-and-line gear. The hook-and-line effort is primarily trolling. The biological opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of any of these species and an ITS was provided.

Southeastern shrimp trawl fisheries affect sea turtles in the Atlantic. As sea turtles rest, forage, or swim on or near the bottom, they are captured by shrimp trawls pulled along the bottom. 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 turtles interacted with in this fishery (NRC 1990). The level of annual mortality described in NRC (1990) is believed to have continued until 1992-1994, when U.S. law required all shrimp trawlers in the Atlantic to use TEDs, which allowed some turtles to escape nets before drowning (NMFS 2002). TEDs approved for use have had to demonstrate 97 percent effectiveness in excluding sea turtles from trawls in controlled testing. Despite the apparent success of TEDs for some species of sea turtles (e.g., Kemp's ridleys), it was later discovered that TEDs were not adequately protecting all species and size classes of sea turtles. Analyses by Epperly and Teas (2002) indicated that the minimum requirements for the escape opening dimension in TEDs in use at that time were too small for some sea turtles and that many of the loggerheads stranding annually along the Atlantic were too large to fit the existing openings. In February 2003, NMFS implemented revisions to the TED regulations addressing that problem (68 FR 8456, February 21, 2003). The revised TED regulations were expected to reduce shrimp trawl related mortality by 94 percent for loggerheads and 97 percent for leatherbacks.

In addition to improvements in TED designs, interactions between sea turtles and otter trawls in the years leading up to this consultation were also thought to be declining because of reductions of fishing effort unrelated to fisheries management actions. Over the past ten years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of hurricanes in the Gulf of Mexico have all impacted shrimp fleets; in some cases reducing fishing effort by as much as 50 percent in offshore waters of the Gulf of Mexico (GMFMC 2007). For example, the estimated annual number of interactions and mortalities between sea turtles and shrimp trawls in the Gulf shrimp fisheries (state and federal) under the new regulation (68 FR 8456, February 21, 2003) based on Epperly et al. (2002) estimated catch per unit effort and updated 2007 effort data in Nance et al. (2008) were significantly less than predicted in the 2002 opinion. However, given elevated strandings in the northern Gulf of Mexico during the springs of 2010 and 2011, necropsy information indicating that drowning may have contributed to many of the mortalities, and evidence of TED compliance issues in the fisheries, these estimates likely underrepresented actual past effects from shrimp fisheries in the Gulf of Mexico.

#### 4.2.1.2 HMS Atlantic Shark Fisheries

NMFS recently issued a biological opinion on the continued authorization of Highly Migratory Species Atlantic shark fisheries (NMFS 2008). This commercial fishery uses bottom longline and gillnet gear. The recreational sector of the fishery uses only hook-and-line gear. To protect

declining shark stocks, the proposed action seeks to greatly reduce the fishing effort in the commercial component of the fishery. These reductions are likely to greatly reduce the interactions between the commercial component of the fishery and sea turtles. The biological opinion provided an ITS that concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by operation of the fishery but that the proposed action was not expected to jeopardize the continued existence of any of these species.

#### 4.2.1.3 Construction and Operation of Public Fishing Piers

Several public fishing piers have been operating along the North Carolina coast for decades. However, the actual number of piers has been decreasing. In 1992, there were 36 public piers. In 2011, there were only 20 left, due to hurricanes and real estate development. A few piers have been proposed for construction, but dwindling funding sources have prevented them from going forward with construction. NMFS has not been requested to consult on the proposed construction of new piers. NMFS is not aware of any sea turtle takes that may have occurred on North Carolina fishing piers.

#### 4.2.1.4 Dredging

Nearshore, and offshore areas of North Carolina are regularly dredged for maintenance of navigation channels and for sand mining. The total environmental impact of dredging in the southeastern United States is unknown, but undoubtedly great (SAFMC 1998). An analysis of 18 major southeastern estuaries (Orlando, P. H. Wendt et al. 1994) recorded over 703 miles of navigation channels and 9,844 miles of shoreline modifications. Habitat effects of dredging include the loss of submerged habitats by disposal of excavated materials, turbidity and siltation effects, contaminant release, alteration of hydrodynamic regimes, and fragmentation of physical habitats (SAFMC 1998). Cumulatively, these effects have degraded habitat areas used by sea turtles.

The construction and maintenance of federal navigation channels, and nearshore and offshore sand mining activities, have been identified as sources of sea turtle mortality because these activities are often performed by hopper dredges. Hopper dredges are large, ocean-going vessels that move relatively rapidly (compared to sea turtle swimming speeds) and can entrain and kill sea turtles as the trailing, suction dragheads of the forward-moving dredge overtake the slower moving sea turtle. The USACE has the 1997 SARBO from NMFS addressing hopper dredging in the Atlantic. In the SARBO, NMFS concluded that sea turtles can be adversely affected by hopper dredges and included ITS, pursuant to Section 7 of the ESA. The ITS contains reasonable and prudent measures with implementing terms and conditions to help minimize these interactions.

#### 4.2.1.5 Beach Nourishment

NMFS has not been requested by the USACE to consult on previous beach nourishments occurring on North Carolina's coast as these activities are covered under the SARBO. Since these events occur primarily during the winter months, when sea turtles are not likely to be found in the shallow waters adjacent to beaches, there should be no adverse affects to swimming sea turtles from the nourishment activities associated with the proposed project.

#### 4.2.1.6 ESA Section 10 Permits

The ESA allows the issuance of permits to capture/interact with ESA-listed species for the purposes of scientific research, under ESA Section 10(a)(1)(A). Authorized activities range from photographing, weighing, and tagging protected species incidentally taken in fisheries, to blood sampling, tissue sampling (biopsy), and performing laparoscopy on intentionally-captured organisms. The number of authorized takes varies widely depending on the research and species involved, but may involve the taking of hundreds of individuals annually. Most captures/interactions 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 pursuits can have adverse effects on sea turtles through propeller and boat strike damage. The extent of the impact on sea turtles in the action area is not known at this time.

#### 4.2.2.2 State Fisheries

Recreational fishing from private vessels, private and public piers, and from shore does occur in the area. Observations of state recreational fisheries have shown that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles are known to bite baited hooks, and loggerheads frequently ingest the hooks. Hooked turtles have been reported by the public fishing from boats, beaches, and jetties and from commercial fishermen fishing for reef fish and sharks (NMFS 2001b). Additionally, lost fishing gear such as line cut after snagging on rocks, or discarded hooks and line, can also pose an entanglement threat to sea turtles in the area. A detailed summary of the known impacts of hook-and-line incidental captures to loggerhead sea turtles can be found in the TEWG reports (1998; 2000).

Although few of these state regulated fisheries are currently authorized to incidentally capture or kill listed species, several state agencies have approached NMFS to discuss applications for a Section 10(a)(1)(B) incidental take permit. Since NMFS' issuance of a Section 10(a)(1)(B) permit requires formal consultation under Section 7 of the ESA, the effects of these activities are considered in Section 7 consultation. Any fisheries that come under a Section 10(a)(I)(B) permit in the future will likewise be subject to Section 7 consultation. Although the past and current effects of these fisheries on listed species are currently not determinable, based upon observations of sea turtles stranded as a result of recreational fishing activities (STSSN data provided by W. Teas, NMFS, pers. comm. to A. Brame, NMFS, April 22, 2011), NMFS believes that ongoing state fishing activities may be responsible for seasonally high levels of observed strandings of sea turtles on both the Atlantic and Gulf of Mexico coasts.

### 4.2.3 Other Potential Sources of Impacts in the Environmental Baseline

#### 4.2.3.1 Marine Debris

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

#### 4.2.3.2 Environmental Contamination

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 (Colbum et al. 1996) and smalltooth sawfish. 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 contaminants do not likely affect the more pelagic waters, sea turtles analyzed in this biological opinion travel between nearshore and offshore habitats and may be exposed to and accumulate these contaminants during their life cycle.

#### 4.2.3.3 Conservation and Recovery Actions Shaping the Environmental Baseline

NMFS has implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles from commercial fisheries in the action area. These include sea turtle release gear requirements for Atlantic HMS fisheries (50 CFR 635), and TED requirements for the southeastern shrimp trawl fisheries (50 CFR 223.207). These regulations have relieved some of the pressure on sea turtle populations.

#### 4.2.3.4 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 coast that collects data on dead sea turtles, and also rescues and rehabilitates any live stranded sea turtles.

#### 4.2.3.5 Sea Turtle Handling and Resuscitation Techniques

NMFS published a final rule (66 FR 67495, December 31, 2001) detailing handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the final rule. These measures help to prevent mortality of hard-shelled turtles caught in fishing or scientific research gear.

A final rule (70 FR 42508) published on July 25, 2005, allows any agent or employee of NMFS, the USFWS, the U.S. Coast Guard, or any other federal land or water management agency, or any agent or employee of a state agency responsible for fish and wildlife, when acting in the course of his or her official duties, to take endangered sea turtles encountered in the marine environment if such taking is necessary to aid a sick, injured, or entangled endangered sea turtle,

or dispose of a dead endangered sea turtle, or salvage a dead endangered sea turtle that may be useful for scientific or educational purposes. NMFS already affords the same protection to sea turtles listed as threatened under the ESA (50 CFR 223.206(b)).

On August 3, 2007, NMFS published a final rule requiring selected fishing vessels to carry observers on board to collect data on sea turtle interactions with fishing operations, to evaluate existing measures to reduce sea turtle takes, and to determine whether additional measures to address prohibited sea turtle takes may be necessary (72 FR 43176). This rule also extended from 30 to 180 days, the maximum period NMFS observers may be placed on vessels 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,.

### 4.2.4 Other Actions

A revised recovery plan for the loggerhead sea turtle was completed December 8, 2008 (NMFS and USFWS 2008). Recovery teams comprised of sea turtle experts have been convened and are currently working towards revising other 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 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 the time. However, further review of species data for the green, hawksbill, leatherback, and loggerhead sea turtles was recommended, to evaluate whether distinct population segments (DPS) should be established for these species (NMFS and USFWS 2007a; NMFS and USFWS 2007b; NMFS and USFWS 2007c; NMFS and USFWS 2007d; NMFS and USFWS 2007e). The Services published a final rule on September 22, 2011, listing loggerhead sea turtles as separate DPSs.

### 4.2.5 Summary and Synthesis of Environmental Baseline

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 1980's, when effort in most fisheries was near or at peak levels. With the decline of the health of managed fishery species, fishing effort since that time has generally been declining. However, interactions with commercial and recreational fishing gear are still ongoing and are expected to occur contemporaneously with the proposed action. Other environmental impacts including effects of vessel operations, dredging, oil and gas exploration, permits allowing take under the ESA, and marine pollution have also had and continue to have adverse effects on sea turtles in the action area in the past.

## 5 Effects of the Action

This section assesses the direct and indirect effects of the proposed action on threatened and endangered species or critical habitat, together with the effects of other activities that are

interrelated or interdependent (50 CFR 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). The ODMDS and subsequent nourishment of Bogue Banks are considered interrelated action to the proposed action. This section examines the likely effects (direct and indirect) of the proposed action on loggerhead and green sea turtles and their habitat from hopper dredging and relocation trawling in the action area within the context of the species status now and projected over the course of the action, the environmental baseline, and cumulative effects.

Below, the discussion will consider the effects of hopper dredging, vessel transit, and relocation trawling on loggerhead and green sea turtles. Last, there is a discussion of the interdependent and interrelated actions associated with the proposed action.

## 5.1 Dredging in Federal Waters

Dredging in federal waters will be conducted by a hopper dredge. Sand will be excavated from Morehead City ODMDS and transported to the Bogue Banks beach nourishment area where it will be discharged at a pump-out station and pumped through pipeline onto the recipient beach. It is anticipated that the hopper dredge will discharge approximately 10,000 to 15,000 cubic yards of sand per day, resulting in up to three to four round-trips from the borrow area to the pipeline per day. The dredge and fill activities will be limited to November 16 – March 31, to avoid sea turtle nesting season. Construction is expected to require approximately two to three months for completion.

Dredging for the Bogue Banks beach renourishment project is expected to remove approximately 992,000 cubic yards from federal waters. No dredge vessel collisions are expected with sea turtles (as distinguished from entrainment in dredge dragheads) in either state or federal waters due to the slow speed of the dredge (i.e., two to three knots while dredging) and the avoidance behavior of sea turtles to slow moving vessels.

During dredging operations, protected species observers (PSOs) will live aboard the dredge(s), and monitor 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 inflow will be screened. Cages will be attached to the ends of discharge pipes, be constructed of steel bar-stock, and welded in a grid pattern with openings approximately 4-inch by 4-inch. PSOs will clean and inspect these screens, 24 hours a day, to document any evidence of sea turtle interactions by looking for sea turtle body parts. PSOs 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-approved PSOs monitor dredged material inflow and overflow screening baskets on many hopper dredging projects, and PSOs will be required to monitor the proposed action.

Dredged material screening, however, is only partially effective, and observed interactions likely provide only partial estimates of total sea turtle mortality. NMFS believes 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 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 Gulf of Mexico Regional Biological Opinion (GRBO) (NMFS 2003b), in making its jeopardy analysis, NMFS 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 continue to use in the present opinion, since we have no new information that would change the basis of that previous conclusion and estimate.

## 5.2 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, it has constituted a legitimate reasonable and prudent measure in past NMFS biological opinions on hopper dredging. Permitted relocation trawling reduces the level of almost certain injury and mortality of sea turtles by hopper dredges by allowing the non-injurious capture of the sea turtles 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 interactions as an RPM at 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 it is en route 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 the turtle in a modified shrimp net, bringing it onboard the trawler, and transporting it approximately 3-5 miles from the dredging site where it is released into the ocean. Dickerson et al. (2007) analyzed historical data for USACE dredging projects in the Atlantic Ocean and Gulf of Mexico and concluded that relocation trawling is effective at reducing the rate of sea turtle entrainment by hopper dredges. Dickerson et al. (2007) also found that the effectiveness of relocation trawling was increased: (1)

when the trawling was initiated at the beginning or early in the project, and (2) by the intensity of trawling effort (i.e., more time trawling per hour). Dickerson (pers. comm. 2008) noted that when a relocation trawler is used – whether or not turtles are actually captured – the incidence of lethal sea turtle take by hopper dredges decreases. Dickerson concluded that the action of the trawl gear on the bottom results in stimulating turtles off the bottom and into the water column, where they are no longer likely to be impacted by the suction draghead of a hopper dredge. The effects of relocation trawling on sea turtles will be further discussed below.

### 5.2.1 Effects of Recapturing of Sea Turtles 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 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, USACE, pers. comm. via e-mail to E. Hawk, NMFS, February 22, 2011). Trawling that occurred over 200 days in the Town of Longboat Key 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. Table 1 below compares the various recapture rates for relocation trawling. More recently, from April 11-June 11, 2011, at the 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). The channel maintenance dredging project at Gulfport, Mississippi, relocated 71 turtles, with one recapture, from April 23-July 27, 2011.

Table 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) |
| 69 | Minimum 3-4 miles | 0 | N/A | T. Bargo, REMSA, pers. comm. to Eric Hawk, NMFS SER, June 2, 2003 |
| 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, USACE, pers. comm. via e-mail to E. Hawk, NMFS, February 22, 2011 |
| 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, Mississippi 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 timely (within 42 minutes, as required by the GRBO); 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.

### 5.2.2 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.

Since 1991, the USACE has documented numerous 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 USACE 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 (Sea Turtle Warehouse Data; 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 (USACE Sea Turtle Warehouse; pers. comm. T. Jordan, USACE, to E. Hawk, NMFS, May 23, 2011). Some of these incidents are described below.

Rarely, properly conducted relocation trawling can result in accidental sea turtle deaths, as the following examples illustrate. Dr. Terry 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 USACE, 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).

Current NMFS Southeast Regional 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 to 30 minutes of bottom-trawling time. As previously stated, the USACE 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 USACE'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, USACE dredging projects relocated 1,216 turtles in the Gulf of Mexico and South Atlantic; there were only 5 documented mortalities during those relocation events, or 0.4 percent overall (USACE Sea Turtle Data Warehouse, queried June 14, 2011), including the three aforementioned Chandeleur Islands mortalities in 2010.

Even though relocation trawling involves the capture and collection of sea turtles, it has constituted a legitimate reasonable and prudent measure 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. 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, NMFS will in this section 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.

NMFS believes 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, NMFS estimates 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 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).

Since October 2011 to 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 (USACE 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 (Gulf Regions =844; Atlantic Region=395). Loggerhead is the predominant species for both dredge interactions and relocation trawling interactions with sea turtles. Kemp's ridley ranks second. Green turtles have been captured in trawls only during December through March in the Gulf of Mexico. Although 2 hawksbills and 6 leatherbacks were relocated during 1995-2006, neither of these species have ever been killed by a dredge. However, during the Destin-Fort Walton Beach, Florida, beach nourishment project in December 2006, one leatherback was drowned accidentally when the relocation trawl net in which it was captured got entangled in bottom debris (it took the crew several hours before they were able to free the net and lift it to the surface) (Dickerson et al. 2007).

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. Non-injurious interactions may be expected with the implementation of relocation trawling.

### 5.2.3 Estimates of Lethal and Non-Injurious Effects of Dredging and Relocation Trawling, Respectively, on Sea Turtles

We must determine the number of turtles that may be killed (by hopper dredging and/or relocation trawling) and the number of turtles that may be taken, non-lethally, by the act of capturing and relocating them during relocation trawling. We will begin our analysis with an estimate of the number of turtles that may be killed by hopper dredging. We will use the 1994 to 2009 Morehead City Harbor dredging reports as a proxy to estimate take from the proposed action. These past maintenance dredging events used the Morehead City ODMDS as a disposal site. The USACE has posted reported sea turtle takes from these dredging events on their Sea Turtle Data Warehouse web site (http://el.erdc.usace.army.mil/seaturtles/info.cfm?Type=District&Code=SAW). Sea turtle takes have occurred in association with seven of these fourteen dredging events resulting in the take of fifteen loggerhead sea turtles and one green sea turtle. The number of takes per dredging event ranged from one to six turtles. Seven of the dredging events did not result in any take.

Relocation trawling was not utilized for most years unless more than one take occurred and then relocation trawling was initiated.

The total number of cubic yards dredged for the Morehead City Harbor maintenance during 1994 through 2009, was 14,818,701. The total number of sea turtles that were killed by hopper dredge in association with these dredging events was fifteen loggerheads and one green sea turtle. If we divide the total number of cubic yards dredged (14,818,701) by the total number of sea turtles taken by hopper dredge (sixteen), this equals one *observed* sea turtle mortality for every 926,169 cubic yards dredged. The proposed action would dredge approximately 992,000 cubic yards of material from the ODMDS. Based on the calculations above, if we round off the numbers, only one turtle would be killed by the proposed action. Therefore, we believe that the proposed action will result in only one *observed* kill (by hopper dredge) for every 992,000 cubic yards dredged. However, it is also important to consider the time of year of the dredging. When we consider the months proposed for dredging (November 16 – March 31), eight of the sixteen turtle takes occurred during the months of November and December. Since dredging during these months is proposed for this project, we believe there will be a higher probability of an encounter with sea turtles and estimate that there will be at least four takes during the proposed dredging event. Warmer sea temperatures may also increase turtle abundance in the borrow area as it is located closer to the Gulf Stream than the dredging conducted in the Morehead City Harbor. Since dredging will occur further offshore than the Morehead City dredging events, we also considered stranding and fisheries data collected for the South Atlantic that may be representative of the species' relative abundances. NMFS data for the entire South Atlantic suggests that the ratio of loggerhead to green sea turtles is approximately 2:1, with decreasing green turtle abundance with increasing latitude. Based on the project location, we believe the ratio of loggerheads to greens is more likely 3:1. *Based on our assessment, we believe that the proposed action has the potential to kill (by interaction with hopper dredge suction dragheads ) at least three loggerhead sea turtles and one green sea turtle during dredging.* A discussion of observed vs. unobserved takes follows later in the sub-section titled *Anticipated, Authorized Sea Turtle Lethal Interactions by Hopper Dredge.*

In addition to lethal interactions by hopper dredge, sea turtles may be captured by relocation trawling. As discussed above, we believe that the majority of sea turtles affected by relocation trawling will not be injured or killed. Nevertheless, the effects of capture and handling on sea turtles during relocation trawling can result in elevated levels of stressor hormones and tagging procedures can cause some discomfort. Based on past observations obtained during similar research-trawling for turtles, these effects are expected to dissipate within a day (Stabenau and Vietti 1999). Since sea 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. In order to estimate the potential take of loggerhead and green sea turtles associated with relocation trawling for the current project, we used the past results for the Morehead City Harbor maintenance dredging events as the basis for our estimate. However, there was only one dredging event that used relocation trawling and this happened during 1997 after the take of two turtles had occurred by hopper dredging. Based on that data, two loggerhead sea turtles were captured and successfully relocated during seven days of relocation trawling (i.e., no reported injuries or deaths). Relocation trawling was not conducted for the other dredging events. Based on the low number of past relocation trawling events, NMFS is unable to determine an estimate

for potential non-lethal takes due to relocation trawling, so in order to estimate potential non-lethal take, we analyze how the relocation gear may interact with sea turtles. When comparing the size of the draghead to the much larger relocation trawling gear, we believe there is increased potential for encounters during relocation trawling. Therefore, we conservatively estimate that at least eight sea turtles (6 loggerhead and 2 green) will be taken during relocation trawling, if implemented. NMFS does not anticipate any lethal takes by relocation trawling.

5.2.4 Anticipated, Authorized Sea Turtle Lethal Interactions by Hopper Dredge

Based on the observed take from past dredging projects, stranding data, the offshore location of the borrow site, and the potential influence of warm currents from the Gulf Stream on the distribution of sea turtles, we believe that the proposed action will result in two *observed* mortalities (documented by hopper dredge observers) during the dredging event. As previously discussed, NMFS believes that for every turtle observed killed (i.e., found dead on the inflow or overflow screening of the hopper dredge by onboard protected species observers monitoring the inflow of dredged material into the hopper), another turtle is killed that is not entrained or is not observed; thus, is not counted. Based on the 50 percent detection rate previously discussed and for purposes of our subsequent jeopardy analysis in Section 7 of this opinion, NMFS assumes that *unobserved* hopper dredge-related mortalities will equal observed hopper dredge-related mortalities.

In Table 2, NMFS estimates that total mortality (observed plus unobserved) by hopper dredge entrainment for this project is four turtles (potentially three loggerhead and one green sea turtle). In addition, we believe the proposed action may non-injuriously capture (by relocation trawling) up to eight sea turtles (two green and six loggerhead sea turtles).

**Table 2.** Estimated turtle take (assuming a 1:1 ratio of lethal observed to lethal not observed for a total of 4 turtle takes using any combination of species)

| **Species** | **Lethal observed** | **or lethal observed** | **or lethal observed** | **Lethal not observed** | **or lethal not observed** | **or lethal not observed** |
|---|---|---|---|---|---|---|
| Green | 0 | 1 | 2 | 0 | 1 | 2 |
| Loggerhead | 2 | 1 | 0 | 2 | 1 | 0 |
| Total | 2 | 2 | 2 | 2 | 2 | 2 |

Since the borrow site is located beyond state waters, NMFS assumes that these interactions will occur in federal waters under BOEM's jurisdiction as a result of hopper dredge suction draghead entrainment during this project. NMFS estimates that the hopper dredge interactions occurring under actions authorized by BOEM will be with loggerhead and green sea turtles, the most common species in the action area. NMFS estimates that four incidental, lethal interactions will occur in federal waters, during the time period of dredging in federal waters. Thus, our jeopardy analysis will consider that up to four sea turtles (3 loggerheads and 1 green) may be killed by hopper dredge entrainment, although only two will be observed/documented. The Incidental Take Statement below will only authorize two (observed) takes of either species for hopper dredging.

### 5.2.5 Effects of Interrelated and Interdependent Actions

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 also be evaluated for the consequent deposition along Bogue Banks. Sand mined from federal waters will be pumped into the nearshore waters adjacent to Bogue Banks beach. Borrow areas in state waters and activities associated with the deposition of sand have been previously considered in the 1997 SARBO issued to the USCAE. Sea turtles are only expected in the very-shallow, nearshore construction area where sand is being deposited during the nesting season. The ODMDS and subsequent deposition of sand along Bogue Banks is not likely to adversely affect sea turtles because these species are unlikely to be present during the project period (November 16 - March 31). Also, there is no nearshore hardground within the project area that serves as important foraging/sheltering habitat for sea turtles that could be impacted. The potential interrelated and interdependent actions will be insignificant to sea turtles.

## 6 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 area may affect sea turtles. Stranding data indicate sea turtles in southeast Atlantic 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 southeast Florida coast have also been known to adversely affect threatened and endangered sea turtles. NMFS is not aware of any proposed or anticipated changes in these fisheries that would substantially change the impacts each fishery has on the sea turtles covered by this opinion.

In addition to fisheries, NMFS is not aware of any proposed or anticipated changes in other human-related actions (e.g., poaching, habitat degradation) or 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 covered by this opinion. Therefore, NMFS expects that the levels of interactions with sea turtles described for each of the fisheries and non-fisheries will continue at similar levels into the foreseeable future.

## 7 Jeopardy Analysis

This section evaluates the likelihood that the proposed action will jeopardize the continued existence of loggerhead and green sea turtles 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 5.0 (Effects of the Action) describes the effects of the proposed action on loggerhead sea turtles, and the extent of those effects in terms of an estimate of the number of sea turtles that would be killed or otherwise "taken." In ESA parlance, 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 considers the effects of BOEM's proposed action in federal waters.

The following jeopardy analysis first considers the effects of the action to determine if we would reasonably expect the action to result in reductions in reproduction, numbers, or distribution of these sea turtle species (including reductions that may not necessarily be observed as discussed in Section 5.0). 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 sea turtles species, the anticipated take of loggerhead and green sea turtles will not appreciably increase the risk of extinction of these species in the wild, or appreciably interfere with achieving recovery objectives for the species.

All 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. 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.

## 7.1 Green Sea Turtles

The non-lethal capture of up to two green sea turtles due to relocation trawling 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. However, the lethal take of one (one documented or one unobserved) green sea turtle 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.

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.

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 any unanticipated take 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.

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 unanticipated take and relocation of turtles captured in relocation 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 population distribution would be expected to remain the same. Therefore, we believe any unanticipated impacts will not affect the species' distribution, and the reductions in numbers and reproduction are not expected to appreciably reduce the species' likelihood of survival in the wild.

We believe that the expected impact of one green sea turtle mortality 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 take 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). State nesting data for 2011 show an increase in green turtle nests to 10,701, the highest number of nests since 1988 (FWRI Web site: http://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/).

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

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.

Any unanticipated take 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 takes by non-lethal capture 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.

## 7.2 Loggerhead Sea Turtles

The non-lethal capture of up to six 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 three (one or two documented and one or two unobserved) 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 three adult female sea turtles 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 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.

Although not included in the NMFS SEFSC (2009) report, in conducting its loggerhead assessment NMFS SEFSC also produced a much less robust estimate for total benthic females in the western North Atlantic, with a likely range of approximately 60,000 to 700,000, up to less than one million. The estimate of overall benthic females is considered less robust because it is model-derived, assumes a stable age/stage distribution, and is highly dependent upon the life history input parameters. Relative to the more robust estimate of adult females, this estimate of total benthic female population is consistent with our knowledge of loggerhead life history and

the relative abundance of adults and benthic juveniles: the benthic juvenile population is an order of magnitude larger than adults. Therefore, we believe female benthic loggerheads number in the hundreds of thousands.

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 3 loggerheads resulting from the proposed action (i.e., 1-2 observed and 1-2 unobserved mortality in dredges) represents the removal of, at most, approximately 0.015 percent ([4/20,000] x 100) of the estimated adult loggerhead female population. Even though we believe the number of benthic females to number in the hundreds of thousands, using the most conservative approach, the level of lethal take of sea turtles by this project represents the removal of only 0.005 percent ([3/60,000] x 100) of the conservatively estimated female benthic loggerhead population. These removals are very small and contribute only minimally to the overall mortality on the population. For benthic juvenile females, the contribution to overall mortality is less. Further, these percentages are likely an overestimation of the impact of the anticipated lethal take resulting from the proposed project on loggerhead sea turtles for the following reasons. These percentages represent impacts to adult and benthic juvenile female loggerhead sea turtles only, and not to the population as a whole. Because this estimated contribution to mortality is a tiny part of our range of uncertainty across what total mortality might be for loggerhead sea turtles, we believe that the small effect posed by the lethal take resulting from the proposed project will not result in a detectable or appreciable reduction in the species' likelihood of survival in the wild.

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.

Loggerhead nest counts on Florida's index beaches have declined from a peak of nearly 60,000 in 1998. However, 2011 counts were close to the average of the previous five years. Although this may be the beginning of a stabilizing trend, additional good nesting years will be required to reverse the preceding decline (FWRI Web site: http://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/).

The potential lethal take of three 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 take of up to six non-lethal captures 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.

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 sea turtles and loggerhead sea turtles in the wild.

## 8 Conclusion

Based on the analyses of the proposed action on green sea turtles, 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. Our analyses focused on the impacts to, and population responses of these species in the Atlantic basin. However, the impact of the effects of the proposed action on the Atlantic populations must be directly linked to the global populations of the species, and the final jeopardy analysis is for the global populations as listed in the ESA.

## 9 Incidental Take Statement (ITS)

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

Section 7(b)(4)(c) of the ESA specifies that in order to provide an incidental take statement for an endangered or threatened species of marine mammal, the taking must be authorized under Section 101(a)(5) of the MMPA. Since no incidental take of listed marine mammals is expected or has been authorized under Section 101(a)(5) of the MMPA, no statement on incidental take of endangered whales is provided, and no take is authorized. Nevertheless, BOEM must immediately notify (within 24 hours, if communication is possible) NMFS' Office of Protected Resources should a take of a listed marine mammal occur.

## 9.1 Anticipated Amount or Extent of Incidental Take

Section 9 of the ESA and federal regulations pursuant to Section 4(d) of the ESA prohibit 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. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. 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 ESA 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 provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement. This incidental take statement applies only to those actions in federal waters, i.e., those occurring under BOEM's authority.

Based on historical distribution data, hopper dredge observer reports, relocation trawling information, and observations of past strandings, green sea turtles and loggerhead sea turtles may occur in the action area and may be taken by the relocation trawling or hopper dredging operations in federal waters for this project. NMFS anticipates that documented (i.e., by onboard observers) incidental take in federal waters, by injury or mortality, will consist of two sea turtle mortalities (loggerhead and/or green), and the incidental take, by non-injurious relocation trawling, will consist of up to eight sea turtles (loggerhead and/or green) during the time frame of the project in federal waters. In addition, NMFS anticipates that hopper dredging will result in two unobserved lethal takes of sea turtles (loggerhead and/or green).

## 9.2 Effect of the Take

*Sea Turtles*
NMFS has determined the anticipated level of incidental take specified in Section 9.1 will not reduce the likelihood of survival and recovery of the Atlantic populations of green and loggerhead sea turtles and is therefore not likely to jeopardize the continued existence of green sea turtles or loggerhead sea turtles.

## 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 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 BOEM in order for the protection of Section 7(o)(2) to apply. BOEM

has a continuing duty to regulate the activity covered by this incidental take statement. If 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 BOEM:

1. BOEM shall have measures in place to monitor and report all interactions with any protected species (ESA or MMPA) resulting from the proposed action. Reports shall be sent to the Assistant Regional Administrator (Mr. David Bernhart) for NMFS' Protected Resources Division, Southeast Regional Office, 263 13th Avenue South, St. Petersburg, Florida 33701-5505.

2. BOEM will require NMFS-approved observers to monitor dredged material inflow and overflow screening baskets on the hopper dredge.

3. BOEM will require the hopper dredge's sea turtle deflector draghead to be inspected prior to startup of hopper dredging operations. In addition, BOEM shall ensure that all contracted personnel involved in operating hopper dredges receive thorough training on measures of dredge operation that will minimize sea turtle takes.

4. BOEM will implement relocation trawling ahead of hopper dredging if the take of at least one sea turtle occurs.

## 9.4 Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, BOEM is required to comply with the terms and conditions which implement the RPMs. The following terms and conditions are nondiscretionary. BOEM shall require the following terms and conditions to minimize the effects of take on loggerhead and green sea turtles:

1) A project report summarizing the results of the dredging and the sea turtle take (if any) must be submitted to NMFS within 30 working days of completion. Reports shall contain information on project location, start-up and completion dates, cubic yards of material dredged, problems encountered, incidental takings (include photographs, if available) and sightings of protected species, mitigative actions taken (i.e., number and species of turtles relocated during relocation trawling, if relocation trawling is initiated), screening type (inflow, overflow) utilized, daily water temperatures, name of dredge, names of endangered species observers, percent observer coverage, and any other information the BOEM and/or contractor deems relevant. This report must be provided to NMFS' Protected Resources Division at the address provided in RPM 1 above and notification of take shall be provided to NMFS at the following e-mail address within 24 hours, referencing the present opinion by NMFS identifier number (F/SER/2011/06373), title, and date: takereport.nmfsser@noaa.gov. If relocation trawling is initiated, BOEM shall provide NMFS' Southeast Regional Office (address provided in RPM 1 above) with an end-of-project

relocation trawling report within 30 days of completion of the relocation trawling. This report may be included within the project report (RPM 1).

2) The BOEM project manager 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 ask to be notified of any sea turtle strandings in the project area that, in the estimation of the STSSN personnel, bear signs of potential draghead impingement or entrainment. Information on any such strandings shall be reported in writing within 30 days of project end to NMFS' Southeast Regional Office (address provided in RPM 1 above), or included in the project report (Term and Condition # 1). Because of different possible explanations for, and subjectivity in the interpretation of potential causes of strandings, these strandings will not normally be counted against BOEM's take limit (in this biological opinion); however, if compelling STSSN observer reports and evidence convinces NMFS that a turtle was killed by a hopper dredge, that take will be deducted from the Incidental Take Statement's anticipated take level for the project (RPM 1).

3) BOEM shall arrange for NMFS-approved protected species observers to be aboard the hopper dredge to monitor the hopper bin, screening, and dragheads for sea turtles and their remains. For the proposed action, 100 percent observer monitoring is required (RPM 2).

4) Beach observers cannot be used in place of shipboard observers for hopper dredging of borrow areas (RPM 2).

5) For the proposed action, 100 percent shipboard observer monitoring is required year-round. If conditions disallow 100 percent inflow screening, inflow screening can be reduced gradually, but 100 percent overflow screening is required, and an explanation must be included in the project report. The hopper's inflow screens should have 4-inch by 4-inch screening. If BOEM, 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. NMFS believes that this flexible, graduated-screen option may be necessary since the need to constantly clear the inflow screens will increase the time it takes to complete the project; therefore, it will increase the exposure of sea turtles to the risk of impingement or entrainment. Inflow screen clogging should be greatly reduced with these flexible options; however, further clogging (e.g., as when encountering heavy clay or debris) may compel removal of the inflow screening altogether, in which case *effective* 100 percent overflow screening is mandatory. BOEM 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. NMFS, in consultation with the dredging company and BOEM/USACE, shall determine what constitutes effective overflow screening. (RPM 3).

6) If relocation trawling is implemented, the following conditions must be observed (RPM 4):

   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 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. They may be held for up to 24 hours if opportunistic, ancillary, "piggy-back" research (e.g., opportunistic satellite tagging) is proposed.

d. *Weight and Size Measurements and PIT Tagging*: All turtles shall be measured (standard carapace measurements including body depth), tagged (PIT or Inconel), and weighed prior to release when safely possible. Any external tags shall be noted and data recorded into the observer's log. Only NMFS-approved observers or observer candidates in training under the direct supervision of a NMFS-approved observer shall conduct the tagging/measuring/weighing/tissue sampling operations. PIT tagging may only be conducted by observers with PIT-tagging training or experience. This opinion provides the authority to NMFS-approved observers to PIT tag captured sea turtles without the need for an ESA Section 10 permit.

e. *Take and Release Time During Trawling*: Turtles shall be kept no longer than 12 hours prior to release (except as noted in 6.c. above) and shall be released not less than 3 nautical miles (nmi) from the dredge site. Recaptured turtles 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. *Injuries and Incidental Take Quota*: Any protected species injured or killed in federal waters 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 by BOEM at its own expense to the nearest sea turtle rehabilitation facility; all rehabilitation costs and sea turtle transportation costs shall be borne by BOEM. The Karen Beasley Sea Turtle Rescue and Rehabilitation Center in Topsail Beach, NC may be contacted at: (910) 328-3377 or (800) 626-2780.

g. *Flipper Tagging*: All sea turtles captured by relocation trawling shall be flipper-tagged prior to release with external tags which shall be obtained prior to the project from the University of Florida's Archie Carr Center for Sea Turtle Research. This opinion serves as the permitting authority for any NMFS-approved endangered species observer a relocation trawler 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.

h. *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.

i. *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.

j. *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. 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 NMFS-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.

## 10 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 Carteret County, Post-Irene Beach Nourishment Project on Bogue Banks, NMFS provides the following conservation recommendations:

1) BOEM should consider devising and implementing some method of significant economic incentives to hopper dredge operators to engineer solutions to prevent/reduce sea turtle entrainments in hopper dredge suction dragheads, 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, forward-facing waters jets to startle turtles out of the draghead path, etc.

## 11 Reinitiation of Consultation

This concludes formal consultation on BOEM's proposed Carteret County, North Carolina, Post-Irene Beach Nourishment to utilize sand from the Morehead City ODMDS to nourish Bogue Banks in the towns of Emerald Isle and Pine Knoll Shores. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) The amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action.

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