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National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
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F/SER/46:DR

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Department of the Army
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OCT 03 2017

Chief, New Orleans Environmental Branch
U.S. Army Corps of Engineers, New Orleans District
Department of the Army
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Sir or Madam:

The enclosed Biological Opinion ("Opinion") responds to your request for consultation with us, the National Marine Fisheries Service (NMFS), pursuant to Section 7 of the Endangered Species Act (ESA) for the Mississippi State Port Authority/Port of Gulfport application for a U.S. Army Corps of Engineers' (USACE) permit to expand the Port of Gulfport (SER-2015-17454). This Opinion also discusses the Biloxi Marsh Complex (BMC) beneficial use site, which is a project separate from the Port of Gulfport Expansion, but that may potentially be used as a dredge material disposal site for the Port of Gulfport Expansion. The Port of Gulfport Expansion is under the jurisdiction of the USACE Mobile District, while the BMC beneficial use site is under the jurisdiction of the USACE New Orleans District.

The Opinion considers the effects of the port expansion project that will be conducted by the Mississippi State Port Authority on the following listed or proposed listed species and/or critical habitat: blue whale, sei whale, sperm whale, fin whale, Bryde's whale, North Atlantic green sea turtle Distinct Population Segment (DPS), South Atlantic green sea turtle DPS, hawksbill sea turtle, leatherback sea turtle, Northwest Atlantic loggerhead sea turtle DPS, Kemp's ridley sea turtle, Gulf sturgeon, and Gulf sturgeon critical habitat. NMFS concludes that the proposed action is not likely to adversely affect the blue whale, sei whale, sperm whale, fin whale, Bryde's whale, hawksbill sea turtle, and Gulf sturgeon critical habitat. NMFS also concludes that the proposed action is not likely to jeopardize the continued existence of the North Atlantic green sea turtle DPS, South Atlantic green sea turtle DPS, leatherback sea turtle, Northwest Atlantic loggerhead sea turtle DPS, Kemp's ridley sea turtle, and Gulf sturgeon.

NMFS is providing an Incidental Take Statement with the Opinion. The Incidental Take Statement (ITS) describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The ITS also specifies nondiscretionary terms and conditions, including monitoring and reporting requirements with which the USACE and the Mississippi State Port Authority must comply with to carry out the reasonable and prudent measures.

We look forward to further cooperation with you on other USACE projects to ensure the conservation and recovery of our threatened and endangered marine species. If you have any questions regarding this consultation, please contact Dr. Dave Rydene, Consultation Biologist, at (727) 824-5379, or by email at David.Rydene@noaa.gov.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure: Biological Opinion
File: 1514-22.F.6

Endangered Species Act - Section 7 Consultation
Biological Opinion

Activity:	Port of Gulfport Expansion Project, Mississippi Sound, Harrison County, Mississippi (NMFS Consultation Number, SER-2015-17454)
Federal Action Agencies:	U.S. Army Corps of Engineers, Mobile District (USACE) and USACE New Orleans District
Consulting Agency:	National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Southeast Regional Office, Protected Resources Division, St. Petersburg, Florida
Approved by:	Roy E. Crabtree, Ph.D., Regional Administrator NMFS, Southeast Regional Office St. Petersburg, Florida
Date Issued:	Oct 3, 2017

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ACRONYMS AND ABBREVIATIONS

BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
CMPR	Coastal Migratory Pelagic Resources
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DPS	Distinct Population Segment
DWH	*Deepwater Horizon*
EIS	Environmental Impact Statement
ERDC	Engineer Research and Development Center

ESA	Endangered Species Act
FMP	Fishery Management Plan
GMFMC	Gulf of Mexico Fishery Management Council
GRBO	Gulf of Mexico Regional Biological Opinion
GSCH	Gulf Sturgeon Critical Habitat
HMS	Highly Migratory Species
ITS	Incidental Take Statement
LCS	Large Coastal Sharks
m	Meter
mt	Metric Tons
mm	Millimeter
MMPA	Marine Mammal Protection Act
MSFCMA	Magnuson-Stevenson Fishery Conservation and Management Act
NAVD 88	North American Vertical Datum of 1988
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWA	Northwest Atlantic
OCS	Outer Continental Shelf
PLL	Pelagic Longline
PRD	Protected Resources Division
RPM	Reasonable and Prudent Measure
SCS	Small Coastal Shark
SEFSC	Southeast Fisheries Science Center
STSSN	Sea Turtle Stranding and Salvage Network
USACE	U.S. Army Corp of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
yd^3	cubic yards

1 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 *et seq.*), requires each federal agency to "insure 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." To fulfill this obligation, Section 7(a)(2) requires federal agencies to consult with the appropriate Secretary on any action that may affect listed species or designated critical habitat. The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) share responsibilities for administering the ESA. Consultations on most listed marine species and their designated critical habitat are conducted between the action agency and NMFS.

Consultation is concluded after the appropriate Secretary (NMFS or USFWS) determines that the action is not likely to adversely affect listed species or critical habitat, or issues a Biological Opinion ("Opinion") that identifies whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify critical habitat. If either of those circumstances is expected, the Secretary identifies reasonable and prudent alternatives (RPAs) to the action as proposed that can avoid jeopardizing listed species or resulting in the destruction/adverse modification (DAM) of critical habitat. In the Opinion, the Secretary states the amount or extent of incidental take of the listed species that may occur, develops reasonable and prudent measures (RPMs) to reduce the effect of take by the action, delineates methods of monitoring to validate the expected effects of the action, and recommends conservation measures to further conserve the species.

This document represents NMFS's Opinion based on our review of impacts associated with the proposed Port of Gulfport Expansion Project (dredge, fill, and dredge material disposal) and future maintenance dredging and disposal operations using a combination of mechanical, hydraulic cutterhead and/or hopper dredges for dredge and disposal activities. This Opinion will consider project effects on sea turtles (Northwest Atlantic [NWA] loggerhead distinct population segment (DPS), Kemp's ridley, North Atlantic [NA] DPS green, South Atlantic [SA] DPS green, hawksbill, and leatherback); sperm, blue, fin, humpback, Bryde's, and sei whales; Gulf sturgeon; and Gulf sturgeon critical habitat (GSCH) (Unit 8) in accordance with Section 7 of the ESA of 1973. This Opinion is based on project information provided by U.S. Army Corp of Engineers (USACE) and other sources of information, including published literature and summary reports provided by USACE. This Opinion also discusses the Biloxi Marsh Complex (BMC) beneficial use site, which is a project separate from the Port of Gulfport Expansion, but that may potentially be used as a dredge material disposal site for the Port of Gulfport Expansion. The Port of Gulfport Expansion is under the jurisdiction of the USACE Mobile District, while the BMC beneficial use site is under the jurisdiction of the USACE New Orleans District.

2 CONSULTATION HISTORY

This section includes information associated with NMFS's current and past involvement with the Port of Gulfport expansion project pursuant to the Section 7 consultation process with USACE.

April 6, 2010: The Mississippi State Port Authority (MSPA) in conjunction with their consultant Volkert, Inc., held an agency meeting to discuss the Sampling Protocol with resource agencies for the expansion of the Port of Gulfport. NMFS provided a list of comments and considerations during the meeting and followed up with an email to the USACE project manager summarizing the items discussed.

April 16, 2010: USACE posted a public notice (SAM-2009-1768-DMY) advertising the Port of Gulfport expansion project.

March 2, 2011: USACE submitted a letter requesting NMFS be a cooperating agency in the development of an environmental impact statement (EIS) for the proposed Port of Gulfport Expansion Project (SAM-2009-1768-DMY), Harrison County, Mississippi.

March 11, 2011: USACE submitted "Intent to Prepare an Environmental Impact Statement for the Port of Gulfport Expansion Project, Harrison County, Mississippi" (76 FR 13363).

April 18, 2011: NMFS submitted a letter to the USACE accepting the invitation to become a cooperating agency on the proposed Port of Gulfport Expansion Project, Harrison County, Mississippi.

August 9, 2012: USACE hosted a public workshop for the proposed Port of Gulfport Expansion Project, Harrison County, Mississippi.

May 9, 2013: The USACE announced a modification to proposed Port of Gulfport Expansion Project (78 FR 27196). The permit application modification proposes additional dredging and dredged material placement to modify the Gulfport Harbor Federal Navigation Channel (FNC) for a length of approximately 20 miles from the current federally authorized dimensions. The federally authorized turning basin would also be modified, as would the proposed turning basin expansion. The proposed project will include modifications to the authorized FNC and other navigation features to support a navigable channel depth of up to 47 ft in the Mississippi Sound and 49 ft in the Bar Channel plus advance maintenance and allowable over-depth requirements. Modification to navigation features adjacent to the port facilities include deepening the existing Federal turning basin area and port berthing areas, a turning basin expansion, and new berthing areas. Widening the channel may be requested based on results of planned ship simulations.

May 21, 2013: USACE hosted a public open house and scoping meeting for the proposed Port of Gulfport Expansion Project, Harrison County, Mississippi.

October 30, 2015: The Draft EIS Notice of Availability for the proposed Port of Gulfport Expansion Project was posted in the Federal Register (80 FR 66898).

December 21, 2016: NMFS received an updated Biological Assessment.

In addition to the above documents, NMFS, USACE, MSPA, and other consultants and stakeholders have coordinated bi-weekly on the Port of Gulfport Expansion Project in a multi-agency conference call since April 2010. NMFS initiated formal consultation on April 27, 2016.

3 DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

3.1 Proposed Action

The USACE proposes to issue Department of the Army permits to the Mississippi State Port Authority (MSPA)/Port of Gulfport (Port) under Section 10 of the Rivers and Harbors Act of 1899, Section 404 of the Clean Water Act, and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended for the proposed Port of Gulfport Expansion Project. The purpose of the Project is to contribute to the long-term economic development of the State of Mississippi and the Gulf Coast region by expanding the Port footprint and facilities to increase the twenty-foot equivalent unit throughput, provide additional employment opportunities, and to increase the economic benefits produced by the Port. The proposed action involves the dredging and filling of approximately 282 acres of estuarine mud and sand bottom habitat in Mississippi Sound for the construction of wharfs, bulkheads, terminal facilities, container storage areas, intermodal container transfer facilities, an expanded turning basin, and construction of a 4,000-linear-foot (lin ft) breakwater, and the placement of new work- and maintenance-dredged material (refer to Figure 1, Table 1).

The proposed project would consist of: (1) expansion (fill) of the West Pier, (2) expansion (fill) of the East Pier, (3) expansion (fill) in the West Pier Berthing area and North Harbor, (4) construction and maintenance of a breakwater, (5) expansion (initial dredging and future maintenance) adjacent to the federally authorized Turning Basin, (6) placement of dredged material in designated disposal areas, (7) and installation of concrete piles for new wharf construction. The proposed expansion features (i.e., West Pier, East Pier, and North Harbor) would be elevated to +25 feet (ft) above mean sea level to provide protection against future tropical storm surge events. Each feature of the proposed expansion footprint is provided in Table 1. Fill material for pier expansions would be obtained from on-site dredging (if suitable), sites located in coastal counties of Mississippi, or from sources along the Tennessee-Tombigbee Waterway (this material would be transported to the project site by barge). The most likely source of fill material is believed to be the Tennessee-Tombigbee Waterway site. New work and maintenance dredged material would be disposed of per the Dredged Material Management Plan (DMMP) (Anchor QEA LLC 2015, See Appendix F of the EIS).

Table 1. Proposed Project, Direct Impact Estimates

Feature	Estimated Acreage Impact (acres)	Estimated Dredged Material Volume (yd^3)	Estimated Fill Material Volume (yd^3)
West Pier Expansion	155	2,400,000	2,500,000 (sand)
East Pier Expansion	15	560,000	500,000 (sand)
West Pier	9	913,000	Not Yet Known

Berthing and North Harbor Expansion			
Breakwater	18	0	250,000 (riprap)
Turning Basin Expansion	85	3,800,000	N/A
Totals	***282***	**7,673,000***	**3,250,000 (minimum)**
*560,000 yd^3 of dredged material is designated for upland disposal.			

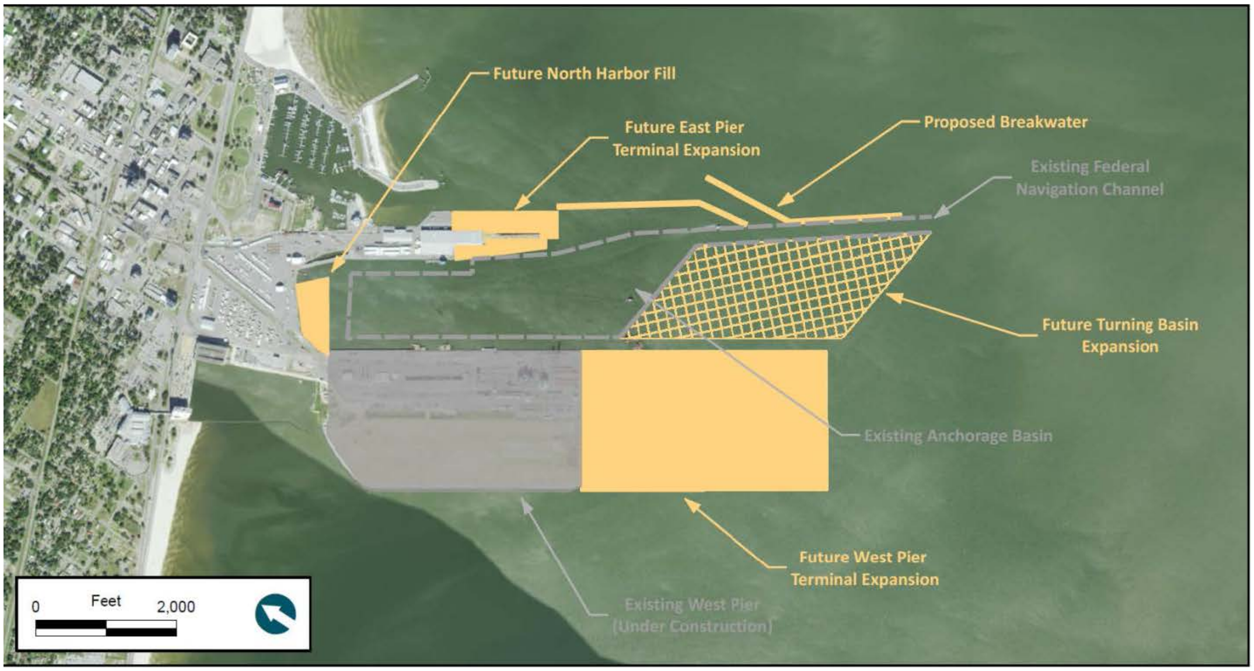

Figure 1. Port of Gulfport Expansion Project Features, Dredged Material Management Plan (Source: Anchor QEA LLC, 2015)

3.1.1 West Pier Expansion

The West Pier Expansion is intended for development of a new concession area consisting of new, multi-use semi-automated container terminals. The proposed concession area would extend to the south of the existing West Pier footprint approximately 3,600 lin ft, adding approximately 155 acres to the existing facility and require 2.5 million cubic yards (mcy) of sand fill material. Prior to construction, the expansion footprint may require dredging for removal of soft to very soft foundation materials and to mitigate mud waves outside of the project footprint. The estimated volume of material that may be removed is 2,400,000 yd^3 (refer to Figure 1, Table 2). The West Pier Expansion is in Gulf sturgeon Critical Habitat (GSCH) Unit 8. First, dredging of material will occur and the material removed will be transported by barge to the disposal site (most likely to diked areas within the BMC site). Next, sand fill material (most likely material that has been transported to the Port from the Tennessee-Tombigbee Waterway site by barge) will be pumped into the expansion footprint.

3.1.2 East Pier Expansion

The East Pier Expansion would add approximately 14.5 acres to the working surface of the Port's existing East Pier facility and require approximately 500,000 yd^3 of sand fill material. This area would be used for rail operations and a new berth, and would provide additional space for the non-container terminal operations tenant (McDermott International). Similar to the West Pier Expansion, this area may require dredging for removal of soft to very soft foundation materials to and mitigate mud waves outside of the project footprint. The estimated volume of material that may be removed is 560,000 yd^3, which generally consists of debris that would be disposed of in permitted and approved upland disposal areas (refer to Figure 1, Table 2). First, dredging of material will occur and the material removed will be transported by barge to shore, and then to the upland disposal site. Next, sand fill material (most likely material that has been transported to the Port from the Tennessee-Tombigbee Waterway site by barge) will be pumped into the expansion footprint. Future maintenance dredging associated with the East Pier berthing area would require removal of approximately 63,000-172,000 yd^3 of material every year (Anchor QEA LLC 2015). The East Pier Expansion is in GSCH Unit 8.

3.1.3 West Pier Berthing and North Harbor Expansion

The West Pier Berthing and North Harbor Expansion would create approximately 9 acres of upland in the area formerly occupied by the *Copa* (a casino boat), but the required fill volumes have not been calculated yet. This upland area would be used as a new berthing area. Both new work dredging associated with the construction of this berth and future maintenance dredging associated with the West Pier and North Harbor berthing areas would be required in this area (Anchor QEA LLC 2015). Prior to construction, the expansion footprint may require dredging for removal of soft to very soft foundation materials. The estimated volume of new work dredged material is 913,000 yd^3. This dredged material would be transported by barge to the disposal site (most likely to diked areas within the Biloxi Marsh Complex site). Following dredging, sand fill material (most likely material brought by barge from the Tennessee-Tombigbee Waterway site) will be pumped into the expansion footprint. At present, existing conditions may preclude the ability to dredge the area as there are cut piles associated with the old *Copa* (a casino boat) within the proposed footprint. The Port has not been able to remove these piles yet. Before design proceeds the site will be investigated to determine the best path forward. The estimated future maintenance dredging volume within the West Pier and North Harbor berthing areas, is between 212,000 and 581,000 yd^3 every year (refer to Figure 1, Table 2) (Anchor QEA LLC 2015). The West Pier Berthing and North Harbor Expansion is in GSCH Unit 8.

3.1.4 Turning Basin Expansion

The existing Gulfport Turning Basin would be expanded to support the West Pier Expansion. The proposed Turning Basin Expansion (approximately 85 acres) would be between the existing Sound Channel and the proposed terminal, immediately adjacent to the Gulfport Turning Basin. This area would be dredged to a depth of -36 ft mean lower low water (MLLW) plus 2 ft of advance maintenance, plus 2 ft of allowable overdepth, and up to an additional 3 ft due to a sediment disturbance layer consistent with the adjacent Federal Navigation Channel (FNC) and USACE maintenance dredging practices. The estimated volume of new work dredged material is 3,800,000 yd^3, and the estimated future maintenance dredging volume is between 211,000 yd^3 and 586,000 yd^3 every year (refer to Figure 1, Table 2) (Anchor QEA LLC 2015). The Turning

Basin Expansion is in GSCH Unit 8. However, NMFS has determined that the Turning Basin is part of the federal navigation channel and is therefore considered exempt under the Gulf sturgeon critical habitat rule. Therefore, the Turning Basin is not considered Gulf sturgeon critical habitat.

3.1.5 Eastern Breakwater

A 4,000 lin ft riprap breakwater is proposed on the eastern side of the FNC to provide protection from tropical storm events. The breakwater would vary from 98- to 102-ft wide at its base with a top width of 10 ft and a top elevation of +10 ft, North American Vertical Datum of 1988 (NAVD 88). The proposed breakwater would require placing approximately 250,000 yd^3 of riprap over a footprint of approximately 18 acres (refer to Figure 1, Table 2). A breach midway along the alignment of the structure is planned to allow shallow-draft access to the FNC from the adjacent Bert Jones Marina. The Eastern Breakwater is in GSCH Unit 8.

3.1.6 Dredged Material Placement

The new work dredging associated with the construction of the proposed West Pier, East Pier, North Harbor, and Turning Basin expansions, is estimated to require removal of approximately 7,673,000 yd^3 of dredged material (Table 2). Following construction of the Turning Basin Expansion, the Mississippi State Port Authority (MSPA) would be responsible for future maintenance dredging of the portion of the new turning basin that is not part of the federally authorized project, as well as the berthing areas associated with the expanded West Pier, East Pier, and North Harbor. Maintenance dredging associated with these areas is anticipated to require removal of approximately 486,000-1,339,000 yd^3 every year. A Dredged Material Management Plan (DMMP) was prepared to evaluate potential placement options for the new work and maintenance dredged material associated with this proposed project (Anchor QEA LLC 2015, See Appendix F in the EIS). Estimated dredged material quantities are shown in Table 2. Estimated dredge quantities assume maintenance for a 30-year period. New work dredging would occur using a mechanical dredge and/or hopper dredge and maintenance dredging would be performed by using a hydraulic dredge, cutterhead dredge, mechanical dredge, or hopper dredge, as necessary.

Table 2. Estimated Dredge Material Quantities

Feature	West Pier Expansion (yd^3)	East Pier Expansion (yd^3)	West Pier Berthing and North Harbor Expansion (yd^3)	Turning Basin Expansion (yd^3)	Total (yd^3)
New Work (BMC or ODMDS disposal)	2,400,000	-	913,000	3,800,000	7,113,000
New Work (upland disposal)	-	560,000	-	-	560,000
Maintenance per year	0	63,000 to 172,000	212,000 to 581,000	211,000 to 586,000	486,000 to 1,339,000
Maintenance	0	1,890,000	6,360,000 to	6,330,000 to	14,580,000 to

over 30-years		to 5,160,000	17,430,000	17,580,000	40,170,000
Future Maintenance Dredging Periodicity	N/A	7-14 Months	7-14 Months	18-47 Months	-

New work dredged material that is structurally suitable would be used for fill at the project site. Any material not structurally suitable would be evaluated for potential beneficial use (BU) and possible placement at a designated or candidate BU site. The Mississippi Department of Marine Resources (MDMR) is pursuing a permit to designate an area in the BMC in Louisiana for beneficial use of dredged material. The goal of this designation is to provide a new BU site on the western side of the state to accommodate material generated from private and public dredging projects (especially the Port of Gulfport expansion) to meet the requirements of Mississippi's beneficial use law. The New Orleans USACE is evaluating the BMC under NEPA and Section 7 of the ESA. Although the BMC is only one of the disposal options under consideration, it is considered the preferred option at present.

BMC containment dikes will be constructed to create 3 fill areas in Biloxi Marsh to receive dredge spoil. The target elevation of the 3 sites (0.5-1.5 ft North American Vertical Datum of 1988) will be achieved by distributing approximately 9,000,000 cubic yards of material dredged from approximately 830 acres (ac) at the Mississippi Port Authority's Port of Gulfport Expansion Project and other unspecified projects. The containment dikes will be constructed by side-casting marsh bottom using a backhoe mounted on a shallow-draft barge or marsh buggy. Following construction of the dikes, a hydraulic pumping barge will be stationed north of the fill sites. Fill material will be transported from the dredging sites to the pumping barge via shallow-draft transport barges. A floating pipeline will be run from the pumping barge to one fill site at a time. The fill material will be distributed in each fill area using shallow draft vessels or marsh buggies to control placement of the discharge end of the pipeline. When each fill area reaches the target elevation, the floating pipeline will be repositioned to fill the next area. The project is expected to take 6-12 months to complete.

For the proposed Port of Gulfport Expansion Project, the Beneficial Use Group (BUG) was in favor of a BU site instead of the Pascagoula Ocean Dredged Material Disposal Site (ODMDS). As such, the BMC is the recommended placement alternative for the new work dredged material for the proposed project (Anchor QEA LLC 2015). The BMC BU site would function to provide needed material for shoreline nourishment and as protection from shoreline erosion on the Mississippi and Louisiana coasts. If the BMC is not permitted prior to dredging, and no other suitable BU sites are available, the Pascagoula ODMDS (see Figure 2) would be used for disposal of new work dredged material if the material is determined to be in compliance with Section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA) (33 USC 28 1413). If the dredged material is not suitable for the ODMDS, the material would be placed in an approved and permitted upland disposal site(s). None of the new work dredged material placement sites proposed are considered to be part of GSCH Unit 8 (Table 3).

The Port would be responsible for maintenance dredging of those areas outside of federal jurisdiction. Maintenance dredged material will be disposed of as discussed in the DMMP (Anchor QEA LLC 2015). The preferred alternative for disposal of maintenance dredged material is thin-layer placement in the open-water sites to the west of the Federal Navigation Channel (FNC). Dredged material is transported to the placement area via discharge pipeline and dispersed by a "spill barge" in a single 6- to 12-inch lift over the surface area. In order to meet the water quality regulations, the spill barge is usually fitted with a diffuser at the end of the dredge discharge pipe. The diffuser is oriented such that the material is discharged at or below the water surface. Additionally, the requirement for dredging and placement for the coastal areas of Mississippi is that turbidity must not exceed 50 Nephelometric Turbidity Units above background outside of the permitted 750-foot mixing zone around the placement areas/discharge location.

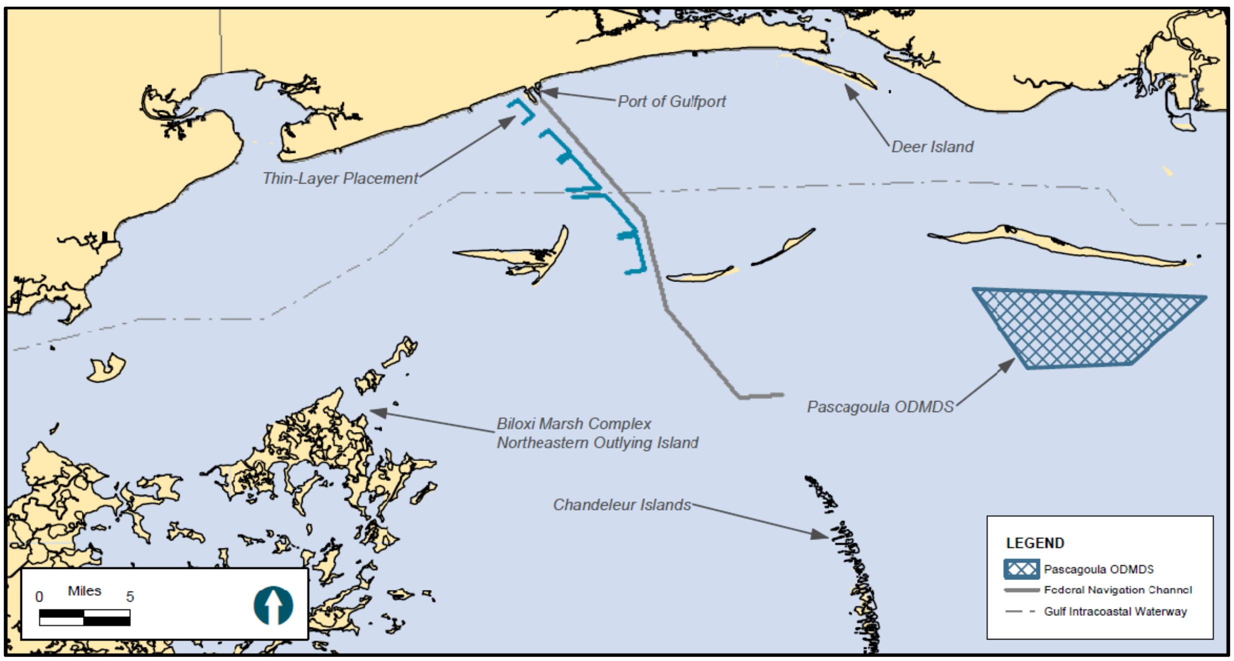

Figure 2. Port of Gulfport Expansion Project Placement Locations, Dredged Material Management Plan. (Source: Anchor QEA LLC, 2015)

Table 3. Placement Sites in relation to Gulf Sturgeon Critical Habitat Unit 8

Thin-layer Placement Site	Pascagoula ODMDS	Biloxi Marsh Complex BU Site	Upland Disposal Site
In GSCH Unit 8	Not in GSCH	Not in GSCH	Not in GSCH

3.1.7 New Wharf Construction

The project includes the installation of approximately 4,000 pre-stressed concrete piles for construction of the new wharf associated with the West Pier Expansion. These piles would consist of approximately 2,680 24-in by 24-in, square pre-stressed concrete piles that range in length from 80 ft to 100 ft. The remaining 1,320 piles would be 36-in cylindrical, hollow, pre-stressed concrete piles installed along the outside edge of the wharf to support the crane rail. The proposed installation plan estimates impact driving 6 piles per day in approximately 20-ft water depth, within a 10-hour work day. Using a single installation rig, the installation would occur 6 days per week and take approximately 2.5 years to complete. However, if a second installation rig is utilized, up to 12 piles could be driven in a single work day. The installation may include pre-augering or jetting the piles for the first 65-70 ft; the remaining 10-15 ft would be driven with a standard impact pile-driving hammer to set the bearing capacity of the pile. The estimated total number of strikes per day would range from 3,768-15,132.

3.1.8 Construction Conditions

Proposed avoidance and minimization measures include reasonable and prudent precautions and actions that have largely been incorporated into USACE civil works projects throughout the Gulf of Mexico for more than a decade (especially for hopper dredging) and are acknowledged by the USFWS and NMFS to reduce impacts to sea turtles and sturgeon. These include onboard observers, screening, sea turtle-deflecting dragheads and dredge pumps, minimizing dredge lighting, and relocation trawling. A summary of these in provided in Sections 11.3 and 11.4.

In addition, the applicant has agreed to only conduct in-water pile driving during daylight hours. At the start of each day's in-water impact driving of piles, the pile-driving hammer shall be started using a ramp-up technique for 10-15 minutes prior to full-force impact driving to allow animals the opportunity to leave the area. Ramp-up involves slowly increasing the power of the hammer, and the noise it produces, over a pre-determined period of time (here, 10-15 minutes). Any break in pile-driving hammer usage for greater than 1 hour will require reinitiating the ramp-up technique before proceeding with full-force impact pile driving. The Port has committed to the use of some form of in-water noise reduction measures (e.g., use of bubble curtains, resonators, or other sound-cancelling options) during impact pile driving to reduce or avoid most potential adverse underwater impacts to marine species from pile-driving activities. The applicant will also follow NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, dated March 23, 2006.

In regards to the construction and utilization of the BMC, the following procedures will be followed to avoid and minimize impacts to ESA-listed species. Turbidity curtains will be deployed and turbidity will be regularly monitored throughout construction. A drip containment system will be used between the barges to minimize spills, and the hydraulic pumping barge will operate in waters of 10 ft in depth or greater to allow any spill to be diluted as much as possible. The proposed pipeline routes are designed to minimize the areas of marsh that will be affected by their placement, and the number of times the pipeline will be moved during the fill process will be minimized to reduce impacts to the existing marsh. The applicant will also follow NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions* (March 23, 2006) and *Measures for Reducing the Entrapment Risk to Protected Species*. Construction personnel will monitor the area for protected species during dike or levee construction and operation of any mechanical construction equipment shall cease immediately if a sea turtle is seen within a 50-ft radius of the equipment. Activities will not resume until the protected species has departed the project area of its own volition.

To prevent the potential entrapment of ESA-listed species during the placement of new dredge material into the BMC, the following procedures will be followed. During construction at least one escape route out of the proposed retention structure(s) must be maintained to allow any protected species to exit the area(s) to be enclosed. Escape routes must lead directly to open water outside the construction site and must have a minimum width of 100 feet. Escape routes should also have a depth as deep as the deepest natural entrance into the enclosure site and must remain open until a thorough survey of the area (conducted immediately prior to complete enclosure) determines that no protected species are present within the confines of the structure.

Prior to completing any retention structure by closing the escape route, the applicant will ensure that the area to be enclosed is observed for protected species. Surveys must be conducted by experienced marine observers during daylight hours beginning the day prior to closure and continuing during closure. This is best accomplished by small vessel or aerial surveys with 2-3 experienced marine observers per vehicle (vessel, helicopter, drone, etc.) scanning for protected species. Large areas (e.g. >300 acres) will likely require the use of more than one vessel or aerial survey to ensure full coverage of the area. These surveys will occur in a Beaufort sea state (BSS) of 3 feet or less, as protected species are difficult to sight in choppy water. Escape routes may not be closed until the final clearance determines that no protected species are present within the enclosure site.

All personnel associated with the placement of new dredge material into the BMC will be informed of the potential presence of protected species in the area and the need to prevent entrapment of these animals. All construction personnel will be advised that there are civil and criminal penalties for harming, harassing, or killing protected species. Construction personnel will be held responsible for any protected species harassed or killed as a result of construction activities. All costs associated with monitoring and final clearance surveys are the responsibility of project proponents and must be incorporated in the construction plan.

If protected species are regularly sighted over a 2 or 3 day period or become entrapped within the enclosure area, construction personnel must notify the Federal Action Agency. It is the responsibility of the Federal Action Agency to then coordinate with the NMFS or the appropriate State Coordinator for the Sea Turtle Stranding and Salvage Network (see http://www.sefsc.noaa.gov/species/turtles/stranding_coordinators.htm) to determine what further actions may be required. Construction personnel may not attempt to scare, herd, disturb, or harass the protected species to encourage them to leave the area.

3.2 Action Area

The action area is defined by regulation as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 CFR 402.02). The proposed project is bounded by the limits of the actions described in Section 3.1. The description of the proposed action details the expansion of the Port of Gulfport facilities, the new work and future maintenance dredging required, and the placement locations for this material. It also includes removal of fill material stockpiled at upland sites from the Tennessee-Tombigbee Waterway project and the transportation by barge of that material to the project site.

The project area is located within Mississippi Sound, which is in GSCH Unit 8. Water depths in Mississippi Sound (with the exception of dredged areas of the Port) range from very shallow to about 20 ft. The preferred placement locations cover a large area to the east and west of the project site (see Table 3 and Figure 3). The ODMDS is a 32 square mile area located approximately 2 miles south of Horn Island, which is approximately 25 miles to the southeast of the Port of Gulfport. Water depths at ODMDS range from 38-52 ft. The proposed BMC BU site is located approximately 20 miles to the southwest of the Port of Gulfport (Figure 3). The Tennessee-Tombigbee Waterway lies about 165 miles northeast of the project area. The ODMDS, BMC, and Tennessee-Tombigbee Waterway are not within GSCH.

Habitats at the Port of Gulfport that would be affected by the project include sand/mud bottom that will be dredged or filled. The project would convert 197 acres of Port of Gulfport open water to uplands and deepen 85.5 acres of existing open water habitat. The ODMDS substrate consists of silt, sandy silt and silty sand. The Biloxi Marsh Complex consists of 30,290 acres of islands, bays, and open-water lakes within Breton Sound, and 210,000 acres of estuary that is part of the St. Bernard delta region.

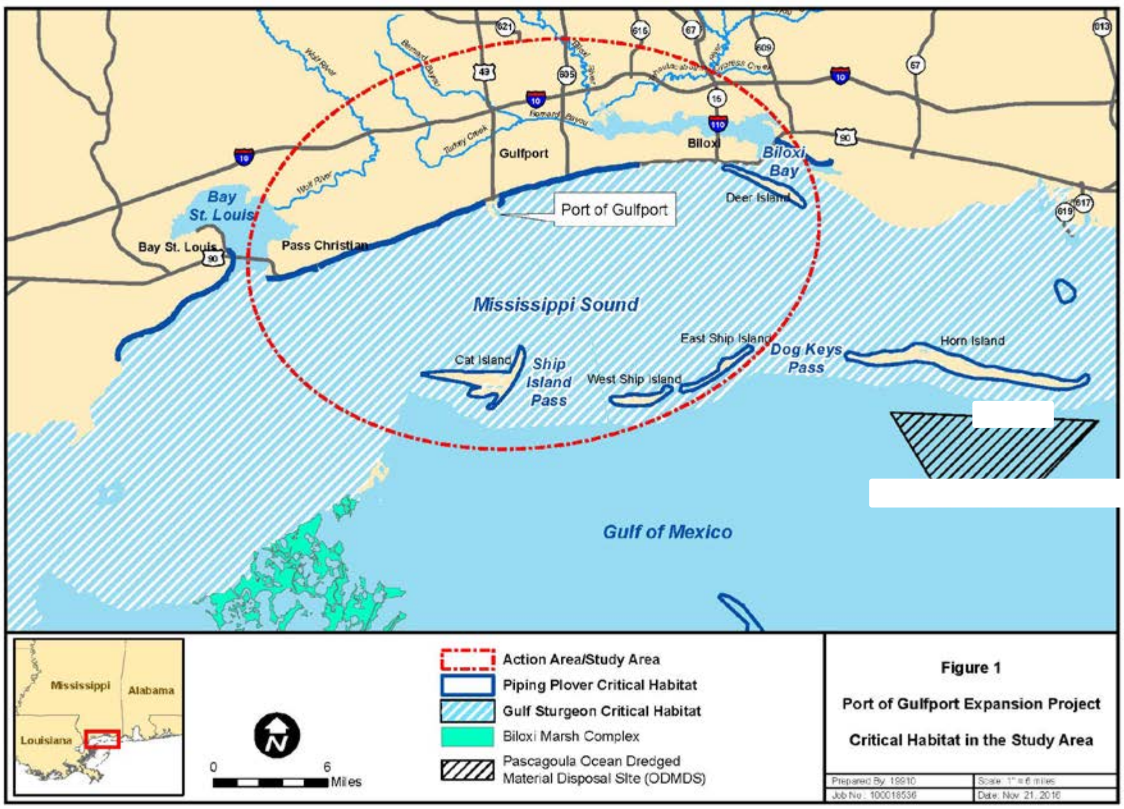

Figure 3. Port of Gulfport Expansion Project Study Area, Biological Assessment. (Source: USACE 2016). Map does not show Tennesee-Tombigbee Waterway due to its distance from the main project area.

4 STATUS OF LISTED SPECIES AND CRITICAL HABITAT

The following endangered (E) and threatened (T) and proposed endangered marine mammal, sea turtle, and fish species, and designated critical habitat under the jurisdiction of NMFS may occur in or near the action area:

Table 4. Effects Determination(s) for Species the Action Agency or NMFS Believes May Be Affected by the Proposed Action

Species	ESA Listing Status	Action Agency Effect Determination	NMFS Effect Determination
Sea Turtles			
Green (North and South Atlantic distinct population segments [DPS])	T	NLAA	LAA
Kemp's ridley	E	LAA	LAA
Leatherback	E	NLAA	LAA
Loggerhead (Northwest Atlantic Ocean DPS)	T	NLAA	LAA
Hawksbill	E	NLAA	NE
Fish			
Gulf sturgeon (Atlantic sturgeon, Gulf subspecies)	T	LAA	LAA
Marine Mammals			
Blue whale	E	NE	NLAA
Fin whale	E	NE	NLAA
Sei whale	E	NE	NLAA
Sperm whale	E	NE	NLAA
Bryde's whale	PE	ND	NLAA
E = endangered; T = threatened; NLAA = may affect, not likely to adversely affect; NE = no effect; ND = no determination; PE = proposed endangered; E = endangered; T = threatened			

Table 5. Critical Habitat NMFS Believes May Be Affected by the Proposed Action

Species	Unit and Status in Florida
Gulf sturgeon	Estuarine – Unit 8

4.1 Potential Effects That Are Not Likely to Adversely Affect Species and Critical Habitat in the Action Area

Marine Mammals

NMFS believes that sperm, blue, fin, sei, and Bryde's whales will not be adversely affected by project activities including the operation of hopper dredges, relocation trawlers, cutterhead dredges, mechanical dredges, dump scows, in-water impact pile-driving of piles, transport of fill material by barge from the Tennessee-Tombigbee Waterway, or dredge material placement operations, because these whale species do not occur in coastal areas (unlike species such as the North Atlantic Right whale). The possibility of collisions with the dredge vessels is also believed to be remote since these are deepwater species unlikely to be found in the project area (The deepest dredged material disposal option occurs at ODMDS where maximums water depths are 52 ft). There has never been a report of a whale taken by a dredge vessel in the Gulf of Mexico. Thus, we believe interactions are extremely unlikely to occur, and the risk is, therefore, discountable.

Given their likely absence, and very low likelihood of interaction, the above-mentioned cetaceans are not considered further in this Opinion; however, it should be noted that incidental take of any marine mammals (listed or non-listed) is not authorized exclusively through the ESA Section 7 process. If such take were to occur, an incidental take authorization under the Marine Mammal Protection Act (MMPA) Section 101 (a)(5) would be necessary. For more information regarding MMPA permitting procedures, contact NMFS Headquarters' Protected Resources staff at (301) 713-2323.

Sea Turtles and Gulf Sturgeon

Sea turtles and Gulf sturgeon are likely to be found in the action area. Sea turtles that may use the action area include green, Kemp's ridley, leatherback, and loggerhead sea turtles. While hawksbill sea turtles could occasionally be found in the action area; hawksbills are the most tropical sea turtle species, ranging from approximately 30°N latitude to 30°S latitude. They are closely associated with coral reefs and other hardbottom habitats, but may also be found in other habitats including inlets, bays, and coastal lagoons (NMFS and USFWS 1993). Adult foraging habitat, which may or may not overlap with developmental habitat, is typically coral reefs, although other hardbottom communities and occasionally mangrove-fringed bays may be occupied. Hawksbills show fidelity to their foraging areas over several years (Van Dam and Diez 1998). The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan 1988). Other food items, notably corallimorphs and zooanthids, have been documented to be important in some areas of the Caribbean (León and Diez 2000; Mayor et al. 1998; Van Dam and Diez 1997). Due to hawksbill sea turtle's preferred habitat and diet, we do not expect them to be present in the action area. Thus, we do not expect interactions with dredges and/or relocation trawls or other project activities. Therefore, there will be no effects of the proposed action on this species. This species will not be discussed further in this Opinion.

Effects to green, Kemp's ridley, leatherback, and loggerhead sea turtles and Gulf sturgeon include the risk of injury from in-water construction machinery (e.g., vessel and barge movements at the construction site, spudding, anchoring, construction equipment operation), which will be discountable due to the species' ability to move away from the project site if disturbed. The applicant's compliance with NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, dated March 2006, will provide an additional measure of protection.

Sea turtles have been documented with injuries consistent with vessel interactions. It is reasonable to believe that the dredge vessels considered in this Opinion could inflict such injuries on sea turtles should they collide. Interactions between vessels and sea turtles occur and can take many forms, from the most severe (death or bisection of an animal or penetration to the viscera), to severed limbs or cracks to the carapace which can also lead to mortality directly or indirectly.

Sea turtle stranding data for the U.S. Gulf of Mexico and Atlantic coasts, Puerto Rico, and the U.S. Virgin Islands show that between 1986 and 1993, about 9% of living and dead stranded sea turtles had propeller or other boat strike injuries (Lutcavage et al. 1997). From 1997 to 2005, 14.9% of all stranded loggerheads in the U.S. Atlantic and Gulf of Mexico were documented as having sustained some type of propeller or collision injuries although it is not known what proportion of these injuries were post or ante-mortem (NMFS and USFWS 2008). The incidence of propeller wounds has risen from approximately 10% in the late 1980s to a record high of 20.5% in 2004 (NMFS, unpublished data). Propeller wounds are greatest in southeast Florida (Palm Beach through Miami-Dade County); during some years, as many as 60% of the loggerhead strandings found in these areas had propeller wounds (Florida Fish and Wildlife Conservation Commission, unpublished data).

Information is lacking on the type or speed of vessels involved in turtle vessel strikes; however, there does appear to be a correlation between the number of vessel-struck turtles and the level of recreational boat traffic (NRC 1990b). Although little is known about a sea turtle's reaction to vessel traffic, it is generally assumed that turtles are more likely to avoid injury from slower moving vessels since the turtle has more time to maneuver and avoid the vessel. The speed of the dredge is not expected to exceed 3-5 knots while dredging or while transiting to the pump out site with a full load and it is expected to operate at a maximum speed of 10 knots while empty. In addition, the risk of ship strike will be influenced by the amount of time an animal remains near the surface of the water. For the proposed action, the greatest risk of vessel collision will occur during transit between shore and the areas to be dredged. The presence of a lookout who can advise the vessel operator to slow the vessel or maneuver safely when sea turtles are spotted will further reduce the potential risk for interaction with vessels. Other vessels, such as small work boats are required to operate at idle speeds in the project area as part of the applicant's compliance with NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, dated March 23, 2006. Therefore, between the slow moving vessels and the presence of a lookout while the dredge vessels are in transit, the risk of interaction between sea turtles and vessels in the action area will be discountable.

Available information on the risk of vessel operations to Gulf sturgeon is discussed in the Environmental Baseline section below. Aside from the incidents discussed there, no information on the characteristics of vessels that are most likely to interact with Gulf sturgeon is available and there is no information on the rate of interactions. Because of their benthic habits and feeding strategy, Gulf sturgeon are unlikely to be struck by dredge vessels or vessel propellers. Nonetheless, assuming that the likelihood of interactions increases with the number of vessels present in an area, we have considered the likelihood that an increase in ship traffic associated with dredging and disposal would increase the risk of interactions between Gulf sturgeon and vessels in the action area. Dredging and disposal for the proposed project are likely to result in an increase of 2-4 slow-moving vessels during project operations. Based on the ship traffic currently experienced in the action area, it is unlikely that an increase of only 2-4 slow-moving vessels per day would increase the risk of interactions between Gulf sturgeon and vessels operating in the project area. In terms of vessel traffic at the Port post-expansion, the goal of the Port expansion is to make the Port more competitive with other ports in the Gulf of Mexico, so that vessels that might have gone to other ports will come to the Port of Gulfport instead. It is not expected that the Port expansion will bring more vessels into the Gulf of Mexico, and while it may redistribute commercial vessel traffic in the Gulf, it is not expected to cause an increased risk of collisions with listed species (P. Hegji, USACE, pers. comm. to D. Rydene, NMFS, June 22, 2017). As such, the increase in risk is likely to be insignificant and interactions between project and commercial vessels and Gulf sturgeon and/or sea turtles are extremely unlikely to occur and, therefore, discountable.

There is also a potential threat of collision with barges transporting fill material from the Tennessee-Tombigbee Waterway to the project site. Fill material produced when the man-made Tennessee-Tombigbee Waterway was originally excavated, would be loaded onto barges from upland storage sites. The barges would travel down the Tennessee-Tombigbee Waterway, Tombigbee River, and Mobile River, and enter Mobile Bay, then head west to the Port of Gulfport for use in the project. Much of the journey will occur in freshwater rivers where sea turtles are not found, but barges might encounter turtles in the estuarine waters of Mobile Bay and during the trip west to the Port of Gulfport. Gulf sturgeon might interact with barges in freshwater, estuarine, or marine waters. Barge and other commercial ship traffic is common along the entire route that the barges will take and the temporary increase in barge traffic due to the project will be very minor compared to the overall commercial vessel traffic that already exists. These barges are relatively slow moving vessels that sea turtles and Gulf sturgeon can avoid. In addition, Gulf sturgeon are demersal fish that tend to stay near the bottom, greatly reducing the chance of collisions with barges. NMFS believes that it is extremely unlikely that sea turtles or Gulf sturgeon would be injured or killed due to interactions with slow-moving, project-associated barges transiting from Tennessee-Tombigbee Waterway borrow sites to the Port of Gulfport, therefore this effect is discountable.

Regarding potential effects to sea turtles from the use of hydraulic dredges, a hydraulic dredge (cutterhead) may be used to excavate material from the project areas and a pipeline would be used to transport and disperse the material within the disposal site or into a transport vessel such as a barge or scow. NMFS has previously determined in Biological Opinions that, while hopper dredges may lethally entrain protected species, non-hopper type dredging methods (e.g., clamshell or bucket dredging, cutterhead dredging, pipeline dredging, sidecast dredging) are unlikely to adversely affect motile listed species, and deems the risk of interactions with motile protected species to be discountable. Despite rare reports of cold-stunned turtles (i.e., torpid, moribund, or previously dead) being taken by cutterhead dredges in the Laguna Madre, Texas, NMFS has no new information that would change the basis of our conclusion that the risk of these takes is discountable when using hydraulic (cutterhead) dredging equipment. The dredge-and-fill activities will not be seasonally limited, but hopper dredging activities will follow temperature- and date-based dredging windows which have been established within the Gulf of Mexico Regional Biological Opinion (GRBO) for minimizing impacts to Gulf sturgeon and sea turtles (NMFS 2003a; NMFS 2005c; NMFS 2007d). Working within these windows, to the extent feasible, will further reduce the risk to listed species, for an activity that is already discountable.

Regarding potential effects to Gulf sturgeon from the use of hydraulic dredges, the USACE has stated that some dredging for this project may be accomplished with a cutterhead (hydraulic) dredge. The cutterhead dredge operates with the dredge head buried in the sediment; however, a flow field is produced by the suction of the operating dredge head. The amount of suction produced is dependent on linear flow rates inside the pipe and the pipe diameter (Clausner and Jones 2004). High flow rates and larger pipes create greater suction velocities and wider flow fields. The suction produced decreases exponentially with distance from the dredge head (Boysen and Hoover 2009). With a cutterhead dredge, material is pumped directly from the dredged area to a disposal site or transport vessel such as a barge or scow. It is generally assumed that sturgeon are mobile enough to avoid the suction of an oncoming cutterhead dredge (due to the noise and vibration created by the cutterhead) and that any sturgeon in the vicinity of such an operation would be able to avoid the intake and escape.

To date, there are no reports from dredge contractors or the USACE of Gulf sturgeon being captured or killed by cutterhead dredges in the Gulf of Mexico. Still, there have been several reports of sturgeon (shortnose and Atlantic) that have been killed during the use of cutterhead dredges. On February 1, 1996, 2 shortnose sturgeon were found in a dredge discharge pool on Money Island, near Newbold Island on the Delaware River. These dead sturgeon were found on the side of the spill area into which the hydraulic pipeline dredge was pumping. An assessment of the condition of the fish indicated that the fish were likely alive and in good condition prior to entrainment. One was an adult male and the other was an adult female with eggs. The area where dredging was occurring was a known overwintering area for shortnose sturgeon and large numbers of shortnose sturgeon were known to be concentrated in the general area. Since that time, dredging operations occurring in the winter months in the Newbold – Kinkora range on the Delaware River require that inspectors conduct daily inspections of the dredge spoil area in an attempt to detect the presence of any sturgeon. In January 1998, 3 shortnose sturgeon carcasses were discovered in the Money Island Disposal Area on the Delaware River. The sturgeon were found on 3 separate dates: January 6, January 12, and January 13. Dredging was being conducted in the Kinkora and Florence ranges at this time, which also overlaps with the shortnose sturgeon overwintering area. While it is possible that not all shortnose sturgeon killed during dredging operations were observed at the dredge disposal pool, USACE has indicated that due to flow patterns in the pool, it is expected that all large material (i.e., sturgeon, logs) will move towards the edges of the pool and be readily observable. In 1998, the USACE Wilmington District had a report of an Atlantic sturgeon killed in a hydraulic pipeline dredge from the Cape Fear River. No documentation or evidence was found to confirm this citation.

The risk of an individual sturgeon being entrained in a cutterhead dredge is difficult to calculate. While a large area overall will be dredged, the dredge operates in an extremely small area at any given time (i.e., the bottom in the immediate vicinity of the intake). Per recent studies, Gulf sturgeon are well distributed throughout the Mississippi Sound; however, they tend to aggregate around the barrier islands during the winter months (October through March). The sturgeon taken by cutterhead dredges mentioned above were in river systems with significantly larger populations, and the dredging was being performed in tight areas where sturgeon were known to aggregate. Given the constraints of the rivers, the probability for take in the river systems is increased. In contrast, relatively few sturgeon have been found in the area between the barrier islands and the proposed project site. One or both of the local subpopulations (Pascagoula and the Pearl) have been documented by tagging data, historic sightings, and incidental captures as using Mississippi Sound, within 1 nmi (1.9 km) of the nearshore Gulf of Mexico adjacent to the barrier islands and within the passes (Morrow Jr. et al. 1996; Reynolds 1993; Rogillio 1993; Rogillio et al. 2001; Ross et al. 2001a; Ross et al. 2009) and F. Parauka, pers. comm. to S.

Bolden, NMFS, December 2, 2002. Studies performed by (Peterson et al. 2015) for this project found that individual Gulf sturgeon were detected taking both transitory paths through the Project area, and localized movements within the entire study area which was centered on the Port of Gulfport. This being said, Gulf sturgeon would need to be in the project areas, where they are not likely to aggregate in a manner consistent with the takes in the Cape Fear or Delaware River, within 1 meter (m) of the dredge head to be entrained. Therefore, given the fact that Gulf sturgeon tend to aggregate in areas near the mouth of natal rivers and barrier islands, and based on the lack of incidental take from past projects in the Gulf of Mexico (none have been taken in the Gulf of Mexico to date), the overall risk of entrainment is considered discountable.

Clamshell dredging has the potential to kill or injure sea turtles if the bucket is dropped onto a sea turtle that enters the dredging area and is directly beneath the bucket when it is dropped. NMFS believes this risk is extremely low as sea turtles are highly mobile and are likely to avoid the active construction area, and because a sea turtle would have to be directly under the dredge bucket at the precise moment the bucket dropped. Dredging operations for this project will be continuous (i.e., operating 24 hours each day, 7 days a week). Additionally, the USACE and/or the applicant will follow NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, so that if a turtle is detected in the dredging area, dredging will be suspended. There has only been 1 reported sea turtle take by clamshell dredging from all dredging projects in the Southeast over the past 20+ years. Thus, we believe the potential take of a sea turtle by a clamshell dredge in this project is extremely unlikely and therefore discountable.

Clamshell dredging has the potential to kill or injure Gulf sturgeon if the bucket is dropped onto a Gulf sturgeon that enters the dredging area. NMFS believes this is extremely unlikely because Gulf sturgeon are highly mobile and are likely to avoid the active construction area. Since 1990, there have been no reports of Gulf sturgeon takes by clamshell dredging in the Gulf of Mexico. Thus, we believe the potential take of a Gulf sturgeon by a clamshell dredge in this project is discountable.

Effects to Gulf sturgeon and sea turtles as a result of noise created by the installation of piles (i.e., impact hammering of piles) can physically injure animals in the affected areas or change animal behavior in the affected areas. Injurious effects can occur in 2 ways. First, effects can result from a single noise event's exceeding the threshold for direct physical injury to animals, and these constitute an immediate adverse effect on these animals. Second, effects can result from prolonged exposure to noise levels that exceed the daily cumulative exposure threshold for the animals, and these can constitute adverse effects, if animals are exposed to the noise levels for sufficient periods. Behavioral effects can be adverse if such effects prevent animals from migrating, feeding, resting, or reproducing, for example. All in-water noise levels discussed below are referenced to 1 micropascal. The NMFS-accepted noise thresholds for impact pile driving are 206 decibels (dB) for peak-pressure injury, 187 dB for cumulative sound exposure level (cSEL) injury, 150 dB root mean square (RMS) for behavioral disturbance of fishes, and 160 dB RMS for behavioral disturbance of sea turtles[1].

1 NMFS 2014. Regional General Permit SAJ-82 (SAJ-2007-1590), Florida Keys, Monroe County, Florida.

Based on the proposed pile sizes and materials and the use of up to two installation rigs, the highest measurements of peak pressure recorded at the source during similar in-water pile driving (immediately next to pile driving) are just above the peak pressure injury threshold. NMFS's accepted peak pressure injury threshold is 206 dB for both fish and sea turtles, while peak pressure at the source would be 207 dB. Injuries could occur within 4 ft of pile-driving activities. Due to the construction activities associated with preparing a pile for installation it is unlikely that a sea turtle or Gulf sturgeon would remain within 4 ft of pile-driving operations. The gradual ramp-up of pile-driving force will provide ample opportunity for these species to leave the area as noise levels increase. Also, with the implementation of noise attenuation techniques that applicants have committed to, the peak pressure will be below the injury threshold for pile-driving operations, based on similar pile-driving projects. The applicant's use of NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, dated March 23, 2006, will provide additional measure of protection for sea turtles by causing operations to stop if a turtle is seen within 50 ft of in-water construction activities. Thus, it is extremely unlikely that sturgeon or turtles will be injured by peak pressure noise from the impact hammer installation of concrete piles and the chance of injurious effects from such installation is discountable.

The highest measurements of cSEL recorded at the source during similar in-water pile driving projects (217 dB cSEL) were above NMFS's accepted cSEL injury threshold for fish and sea turtles (187 dB cSEL for fish/sea turtles greater than 2 g in weight). If a Gulf sturgeon or turtle were to remain within 152 ft of pile-driving operations for an entire day of pile driving, and noise attenuation measures were not implemented, injury might result. It is expected that Gulf sturgeon and sea turtles would leave the area during the ramp-up period due to the disturbance caused by the increasing noise levels. A study of acoustically tagged Atlantic sturgeon in the Hudson River was recently conducted as part of the pile-driving demonstration phase of the New New York Bridge (NMFS 2014). Researchers found that fewer sturgeon were detected and they spent less time in the vicinity of the construction areas when pile driving was occurring than during silent control periods. Further, the amount of time sturgeon did spend in areas affected by pile-driving noise was not believed to be long enough to reach the threshold for injurious cSEL effects. This indicates that sturgeon move away from pile-driving activities before noise-induced injury occurs. Thus, it is extremely unlikely that sturgeon or sea turtles will be injured by cSEL noise from the impact hammer installation of concrete piles and the chance of injurious effects from such installation is discountable. An animal's movement away from the injurious impact zone is a behavioral response, with the same effects discussed below.

Pile-driving noise levels at the source will exceed the threshold for potential behavioral disturbance effects to sea turtles and Gulf sturgeon. The NMFS's accepted threshold for behavioral disturbance effects is 150 dB RMS for fish and 160 dB RMS for sea turtles. Based on the highest RMS measurements recorded at the source during similar in-water pile driving projects, sea turtles may exhibit behavioral disturbance effects and swim away to a less noisy area when within 152 ft of pile-driving activities, and Gulf sturgeon when within 707 ft. Due to their expected avoidance of project noise and activity, we would not expect a sea turtle or Gulf sturgeon to remain stationary within those radii of a pile during installation operations. The project has adequate avenues for a sea turtle or Gulf sturgeon to escape or avoid the project area during pile-driving activities and similar habitat types are readily available in the Mississippi Sound. Additionally, the entire project area could still be used by these species during early evening and night hours when pile driving will not be taking place. Therefore, we anticipate any behavioral effects will be insignificant.

Dredge and fill activities will deepen some areas of the Port which may create anoxic conditions on the bottom and will also convert some areas from open water to uplands resulting in a loss of useable submerged sand/mud bottom habitat. Dredge and fill activities may also temporarily degrade water quality in the vicinity of dredging and placement (e.g., increase turbidity). Gulf sturgeon and some sea turtle species may presently shelter in the areas that will be altered by the project. However, there is ample similar habitat surrounding the Port and elsewhere in Mississippi Sound that sturgeon and turtles will still be able to utilize to shelter. Also, the Port is likely suboptimal habitat for sturgeon and sea turtles due to the chronic noise and industrial activity associated with the Port's daily operation. Therefore, we anticipate any effects to Gulf sturgeon and sea turtles from the alteration of water quality will be insignificant.

The project area includes winter migration and feeding habitats for adult and subadult Gulf sturgeon in Mississippi Sound, which includes individuals from the Pascagoula and the Pearl River sub-populations, as well as the Blackwater, Choctawhatchee, Yellow, and Escambia River subpopulations (ERDC 2012), and sea turtles are known to use Mississippi Sound for foraging and resting. Dredge and fill activities will permanently remove 197 ac of water column and soft substrate (due to conversion to uplands) that sea turtles and/or Gulf sturgeon could use for foraging, resting, or as a transitory pathway. In addition, 85 ac of soft substrate will be temporarily be impacted by dredging to expand the Turning Basin and additional soft substrate will be temporarily impacted by periodic maintenance dredging.

NMFS expects that prey items will be impacted both permanently and temporarily within the project footprint. In areas where the benthic fauna is temporarily affected by dredging activities (i.e., dredging of the Turning Basin and maintenance dredging) the benthic fauna is expected to recover, typically within 1 year of completion of the project, however recovery is typically achieved within 3–10 months of thin-layer disposal (Saloman et al. 1982; Wilber et al. 2007). Therefore, although prey abundance will be affected, NMFS expects these effects to be temporary and recovery of prey abundance and availability will occur within a relatively short period of time. The project will permanently impact 197 ac of unvegetated substrate that supports benthic invertebrates. However, the area to be impacted by fill activities is adjacent to an active commercial shipping port with its associated physical disturbance and noise. The Port expansion would result in the filling of 197 acres of sand/mud bottom (to create uplands) that could contain infaunal prey that Gulf sturgeon and sea turtles might feed on. Gulf sturgeon do not appear to use the potentially-impacted areas of the Port as feeding grounds, possibly because density levels of prey species are not high enough to induce feeding by sturgeon, which seem to select areas with relatively high densities of their preferred prey species to feed in (Fox et al. 2000). These lower prey densities may be due to the degradation of the bottom sediments during the construction of the original Port (Peterson et al. 2013). Therefore, although the project will remove prey abundance in areas designated for fill when they are converted to uplands or a breakwater, these particular prey items do not appear to be fed upon by Gulf sturgeon. Also, the loss of potential foraging habitat will be small compared to the total acreage found within Mississippi Sound. Gulf sturgeon are opportunistic feeders that forage over large distances, and thus will be able to locate prey throughout adjacent sandy areas. While habitat known to support prey will be both permanently and temporarily impacted by project activities, it is likely that any Gulf sturgeon or sea turtles in the project area have the ability to find appropriate and abundant prey in the areas adjacent to the project location, as many other nearby similar prey-rich sandy areas exist.

Since the construction of the original Port did not prevent Gulf sturgeon or sea turtles from migrating through Mississippi Sound as needed, NMFS does not believe that expansion of the Port will keep these species from moving to and from their preferred feeding and sheltering areas and river systems (in the case of sturgeon). A recent study by (Peterson et al. 2015) in preparation for this project observed Gulf sturgeon movements between the Pearl and Pascagoula Rivers along the inshore area. The study noted that the existing Port of Gulfport is not impeding migration within the Mississippi Sound. NMFS believes there will be sufficient passage opportunity for Gulf sturgeon to move through the placement area via the adjacent open-water areas during the placement activities and after their completion, so that migratory pathways will not be disrupted. Sea turtles will also still be able to move within Mississippi Sound as needed. The placement of material will occur in primarily open-water areas, and it is likely that the highly mobile Gulf sturgeon and sea turtles will avoid these areas due to project activities (noise and the physical presence of machinery). No other significant short-term or long-term impacts to the migratory passage are anticipated. Therefore, NMFS expects the placement of dredge and fill material (i.e., conversion to uplands), dredging of the Turning Basin, and maintenance dredging will have an insignificant effect on Gulf sturgeon and sea turtles in regards to loss of benthic habitat and ability to transit within Mississippi Sound.

The potential construction of the BMC (the construction of containment structure dikes) could adversely Gulf sturgeon or sea turtles if either species became entrapped within the dikes during their construction. However, this effect will be discountable because NMFS believes that sea turtles and sturgeon will avoid the area due to the noise and physical disturbance caused by the construction of the dikes, and because of the implementation of construction conditions outlined in Section 3.1.8. These construction conditions (including monitoring of the work areas for the presence of protected species, stoppage of work if protected species are seen in the work area, maintenance of “escape routes”, and thorough searches to confirm that no protected species are present within the containment structures before their final closure) are designed to prevent the entrapment of ESA-listed species during dike construction and final closure of the containment structure.

Sea turtles and Gulf sturgeon may be adversely affected by being temporarily unable to use the areas around the BMC marsh creation sites for foraging due to their avoidance of construction activities and related noise. However, we believe these effects will be insignificant because there are ample, similar habitat areas nearby that they can use. In addition, construction of each of the three units will take place at different times, reducing the area that will be disturbed at any given time.

The placement of new dredge material from the project may occur at the BMC, but placement at ODMDS is also a possibility. New dredged material would be transported to either site by barge. Placement at the Biloxi Marsh Complex would have no effect on sea turtles or sturgeon as material would be placed within an earthen wall containment structure at the site. The placement of dredge material at ODMDS would occur over that site's existing sand/mud bottom. This activity might cover and smother infaunal and non-motile benthic invertebrates that might be used as prey by sea turtles and Gulf sturgeon. However, the benthic community would be expected to recover within 1 year or less, so impacts would not be permanent and there is ample benthic habitat supporting similar invertebrate prey assemblages surrounding the ODMDS that turtles and sturgeon could use to forage. Therefore, NMFS believes that effects to sea turtles and Gulf sturgeon from the potential placement of dredge material at ODMDS will be insignificant.

Material dredged from the project area, including the West Pier Expansion, East Pier Expansion, West Pier Berthing and North Harbor Expansion, and Turning Basin (see Table 2), will either be pumped via pipeline directly from the dredging area to the placement area, or the hopper dredge will transit from the dredging areas to the disposal area and pump-out directly onto the disposal areas identified in Table 3. NMFS has reviewed the dredging projects that occur in the Gulf of Mexico on a recurring basis and the placement/disposal sites and methods which the USACE uses to dispose of dredged material. Typically, dredged materials from maintenance dredging activities are disposed of down-current of the navigation channels being maintained (such as the thin-layer placement sites on the west side of the Gulfport Navigation Channel) by agitation dredging, sidecasting, or direct placement, or in designated disposal areas which are adjacent to and run approximately parallel to the navigation channels, or in nearby designated offshore disposal areas (to minimize transit time of the hopper dredge to and from the dredging site). Alternatively, they are used beneficially for barrier island restoration and creation of island, wetland, marsh, and shallow-water habitats, or to re-nourish eroded mainland beaches. NMFS believes that disposal activities proposed are not likely to adversely affect sea turtles or Gulf sturgeon. These species are highly mobile and should be able to easily avoid a descending sediment plume discharged at the surface by a hopper dredge opening its hopper doors, or pumping its sediment load over the side. Therefore we believe the effects of dredged material disposal on sea turtles and Gulf sturgeon will be discountable.

In summary, NMFS concludes that the project activities discussed above are not likely to adversely affect green, Kemp's ridley, leatherback, and loggerhead sea turtles, and Gulf sturgeon because all of these effects will be either discountable or insignificant.

Hopper dredging operations may pose a threat to Gulf sturgeon and sea turtles via incidental capture and/or entrainment by hopper dredges and relocation trawling vessels. NMFS evaluated the threats posed by the proposed project to the above-listed sea turtles and Gulf sturgeon. Based on dredge and trawl take data, sturgeon and turtle diets, and preferred habitats, NMFS believes that Gulf sturgeon and green, Kemp's ridley, leatherback, and loggerhead sea turtles are likely to be adversely affected by the proposed hopper dredging and relocation trawling activities. The effects of these activities on both Gulf sturgeon and these 4 sea turtle species will be discussed further in Section 6.

Gulf Sturgeon Critical Habitat

NMFS and USFWS jointly designated GSCH on April 18, 2003 (*see,* 50 CFR 226.214). The agencies designated 7 riverine areas (Units 1-7) and 7 estuarine/marine areas (Units 8-14) as critical habitat based on the physical and biological features that support the species. Critical habitat units encompass a total of 2,783 river kilometers (rkm) and 6,042 km^2 of estuarine and marine habitats. NMFS's jurisdiction encompasses the 7 units in marine and estuarine waters (Units 8-14). This project is located in Unit 8 of GSCH. Unit 8 encompasses Lake Pontchartrain east of the Lake Pontchartrain Causeway, all of Little Lake, The Rigolets, Lake St. Catherine, Lake Borgne, including Heron Bay, and the Mississippi Sound.

Essential Features of Critical Habitat
NMFS and USFWS identified 7 habitat features essential for the conservation of Gulf sturgeon. Four of these physical and biological features (PBFs) are found in the marine and estuarine units of critical habitat:

1. Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusks and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages
2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages
3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages
4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., an unobstructed river or a dammed river that still allows for passage)

NMFS believes Gulf sturgeon critical habitat may be adversely affected by the dredging and filling of 197 ac of estuarine mud and sand bottom habitat in Mississippi Sound for the construction of wharfs, bulkheads, terminal facilities, container storage areas, intermodal container transfer facilities, and construction of a 4,000-linear-foot (lin ft) breakwater. The effects of these activities on Gulf sturgeon critical habitat will be discussed further in Section 6.

4.2 Overview of Status of Sea Turtles

There are 5 species of sea turtles (green, hawksbill, Kemp's ridley, leatherback, and loggerhead) that travel widely throughout the South Atlantic, Gulf of Mexico, and the Caribbean. These species are highly migratory and (with the exception of hawksbill sea turtles) could therefore occur within the action area. Section 4.2.1 will address the general threats that confront all sea turtle species. Sections 4.3–4.6 will address information on the distribution, life history, population structure, abundance, population trends, and unique threats to each species of sea turtle.

4.2.1 General Threats Faced by All Sea Turtle Species

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

Fisheries
Incidental bycatch in commercial fisheries is identified as a major contributor to past declines, and threat to future recovery, for all of the sea turtle species (NMFS and USFWS 1991; NMFS and USFWS 1992; NMFS and USFWS 1993; NMFS and USFWS 2008; NMFS et al. 2011). Domestic fisheries often capture, injure, and kill sea turtles at various life stages. Sea turtles in the pelagic environment are exposed to U.S. Atlantic pelagic longline (PLL) fisheries. Sea turtles in the benthic environment in waters off the coastal United States are exposed to a suite of other fisheries in federal and state waters. These fishing methods include trawls, gillnets, purse seines, hook-and-line gear (including bottom longlines and vertical lines [e.g., bandit gear, handlines, and rod-reel]), pound nets, and trap fisheries. Refer to the Environmental Baseline section of this opinion for more specific information regarding federal and state managed fisheries affecting sea turtles within the action area). The Southeast U.S. shrimp fisheries have historically been the largest fishery threat to benthic sea turtles in the southeastern United States, and continue to interact with and kill large numbers of sea turtles each year.

In addition to domestic fisheries, sea turtles are subject to direct as well as incidental capture in numerous foreign fisheries, further impeding the ability of sea turtles to survive and recover on a global scale. For example, pelagic stage sea turtles, especially loggerheads and leatherbacks, circumnavigating the Atlantic are susceptible to international longline fisheries including the Azorean, Spanish, and various other fleets (Aguilar et al. 1994; Bolten et al. 1994). Bottom longlines and gillnet fishing is known to occur in many foreign waters, including (but not limited to) the northwest Atlantic, western Mediterranean, South America, West Africa, Central America, and the Caribbean. Shrimp trawl fisheries are also occurring off the shores of numerous foreign countries and pose a significant threat to sea turtles similar to the impacts seen in U.S. waters. Many unreported takes or incomplete records by foreign fleets make it difficult to characterize the total impact that international fishing pressure is having on listed sea turtles. Nevertheless, international fisheries represent a continuing threat to sea turtle survival and recovery throughout their respective ranges.

Non-Fishery In-Water Activities
There are also many non-fishery impacts affecting the status of sea turtle species, both in the ocean and on land. In nearshore waters of the United States, the construction and maintenance of federal navigation channels has been identified as a source of sea turtle mortality. Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore borrow areas, move relatively rapidly and can entrain and kill sea turtles (NMFS 1997). Sea turtles entering coastal or inshore areas have also been affected by entrainment in the cooling-water systems of electrical generating plants. Other nearshore threats include harassment and/or injury resulting from private and commercial vessel operations, military detonations and training exercises, in-water construction activities, and scientific research activities.

Coastal Development and Erosion Control
Coastal development can deter or interfere with nesting, affect nesting success, and degrade nesting habitats for sea turtles. Structural impacts to nesting habitat include the construction of buildings and pilings, beach armoring and renourishment, and sand extraction (Bouchard et al.

1998; Lutcavage et al. 1997). These factors may decrease the amount of nesting area available to females and change the natural behaviors of both adults and hatchlings, directly or indirectly, through loss of beach habitat or changing thermal profiles and increasing erosion, respectively (Ackerman 1997; Witherington et al. 2003; Witherington et al. 2007). In addition, coastal development is usually accompanied by artificial lighting which can alter the behavior of nesting adults (Witherington 1992) and is often fatal to emerging hatchlings that are drawn away from the water (Witherington and Bjorndal 1991). In-water erosion control structures such as breakwaters, groins, and jetties can impact nesting females and hatchling as they approach and leave the surf zone or head out to sea by creating physical blockage, concentrating predators, creating longshore currents, and disrupting of wave patterns.

Environmental Contamination
Multiple municipal, industrial, and household sources, as well as atmospheric transport, introduce various pollutants such as pesticides, hydrocarbons, organochlorides (e.g., dichlorodiphenyltrichloroethane [DDT], polychlorinated biphenyls [PCB], and perfluorinated chemicals [PFC]), and others that may cause adverse health effects to sea turtles (Garrett 2004; Grant and Ross 2002; Hartwell 2004; Iwata et al. 1993). Acute exposure to hydrocarbons from petroleum products released into the environment via oil spills and other discharges may directly injure individuals through skin contact with oils (Geraci 1990), inhalation at the water's surface, and ingesting compounds while feeding (Matkin and Saulitis 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability in the action area.

The April 20, 2010, explosion of the *Deepwater Horizon* (DWH) oil rig affected sea turtles in the Gulf of Mexico. An assessment has been completed on the injury to Gulf of Mexico marine life, including sea turtles, resulting from the spill (DWH Trustees 2015). Following the spill, juvenile Kemp's ridley, green, and loggerhead sea turtles were found in *Sargassum* algae mats in the convergence zones, where currents meet and oil collected. Sea turtles found in these areas were often coated in oil and/or had ingested oil. The spill resulted in the direct mortality of many sea turtles and may have had sublethal effects or caused environmental damage that will impact other sea turtles into the future. Information on the spill impacts to individual sea turtle species is presented in the Status of the Species sections for each species.

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

Climate Change
There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. NOAA's climate information portal provides basic

background information on these and other measured or anticipated effects (see http://www.climate.gov).

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

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

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

Other Threats

Predation by various land predators is a threat to developing nests and emerging hatchlings. The major natural predators of sea turtle nests are mammals, including raccoons, dogs, pigs, skunks, and badgers. Emergent hatchlings are preyed upon by these mammals as well as ghost crabs, laughing gulls, and the exotic South American fire ant (*Solenopsis invicta*). In addition to natural predation, direct harvest of eggs and adults from beaches in foreign countries continues to be a problem for various sea turtle species throughout their ranges (NMFS and USFWS 2008).

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

4.3 Green Sea Turtle

The green sea turtle was originally listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations, which were listed as endangered. On April 6, 2016, the original listing was replaced with the listing of 11 DPSs (81 FR 20057 2016). The Mediterranean, Central West Pacific, and Central South Pacific DPSs were listed as endangered. The North Atlantic, South Atlantic, Southwest Indian, North Indian, East Indian-West Pacific, Southwest Pacific, Central North Pacific, and East Pacific were listed as threatened. For the purposes of this consultation, only the South Atlantic DPS (SA DPS) and North Atlantic DPS (NA DPS) will be considered, as they are the only 2 DPSs with individuals occurring in the Atlantic and Gulf of Mexico waters of the United States.

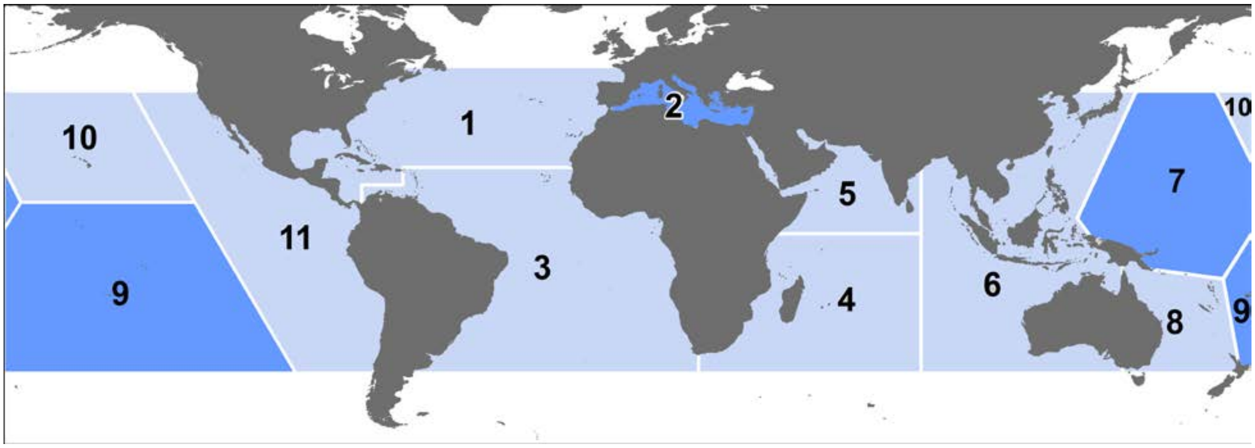

Figure 4. Threatened (light) and endangered (dark) green turtle DPSs: 1. North Atlantic, 2. Mediterranean, 3. South Atlantic, 4. Southwest Indian, 5. North Indian, 6. East Indian-West Pacific, 7. Central West Pacific, 8. Southwest Pacific, 9. Central South Pacific, 10. Central North Pacific, and 11. East Pacific.

Species Description and Distribution

The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 lb (159 kg) with a straight carapace length of greater than 3.3 ft (1 m). Green sea turtles have a smooth carapace with 4 pairs of lateral (or costal) scutes and a single pair of elongated prefrontal scales between the eyes. They typically have a black dorsal surface and a white ventral surface, although the carapace of green sea turtles in the Atlantic Ocean has been known to change in color from solid black to a variety of shades of grey, green, or brown and black in starburst or irregular patterns (Lagueux 2001).

With the exception of post-hatchlings, green sea turtles live in nearshore tropical and subtropical waters where they generally feed on marine algae and seagrasses. They have specific foraging grounds and may make large migrations between these forage sites and natal beaches for nesting (Hays et al. 2001). Green sea turtles nest on sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands in more than 80 countries worldwide (Hirth 1997). The 2 largest nesting populations are found at Tortuguero, on the Caribbean coast of Costa Rica (part of the NA DPS), and Raine Island, on the Pacific coast of Australia along the Great Barrier Reef.

Differences in mitochondrial DNA properties of green sea turtles from different nesting regions indicate there are genetic subpopulations (Bowen et al. 1992; FitzSimmons et al. 2006). Despite the genetic differences, sea turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species' range. Within U.S. waters individuals from both the NA and SA DPSs can be found on foraging grounds. While there are currently no in-depth studies available to determine the percent of NA and SA DPS individuals in any given location, two small-scale studies provide an insight into the degree of mixing on the foraging grounds. An analysis of cold-stunned green turtles in St. Joseph Bay, Florida (northern Gulf of Mexico) found approximately 4% of individuals came from nesting stocks in the SA DPS (specifically Suriname, Aves Island, Brazil, Ascension Island, and Guinea Bissau) (Foley et al. 2007). On the Atlantic coast of Florida, a study on the foraging grounds off Hutchinson Island found that approximately 5% of the turtles sampled came from the Aves Island/Suriname nesting assemblage, which is part of the SA DPS (Bass and Witzell 2000). All of the individuals in both studies were benthic juveniles. Available information on green turtle migratory behavior indicates that long distance dispersal is only seen for juvenile turtles. This suggests that larger adult-sized turtles return to forage within the region of their natal rookeries, thereby limiting the potential for gene flow across larger scales (Monzón-Argüello et al. 2010). While all of the mainland U.S. nesting individuals are part of the NA DPS, the U.S. Caribbean nesting assemblages are split between the NA and SA DPS. Nesters in Puerto Rico are part of the NA DPS, while those in the U.S. Virgin Islands are part of the SA DPS. We do not currently have information on what percent of individuals on the U.S. Caribbean foraging grounds come from which DPS.

North Atlantic DPS Distribution

The NA DPS boundary is illustrated in Figure 4. Four regions support nesting concentrations of particular interest in the NA DPS: Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, and Quintana Roo), U.S. (Florida), and Cuba. By far the most important nesting concentration for green turtles in this DPS is Tortuguero, Costa Rica. Nesting also occurs in the Bahamas, Belize, Cayman Islands, Dominican Republic, Haiti, Honduras, Jamaica, Nicaragua, Panama, Puerto Rico, Turks and Caicos Islands, and North Carolina, South Carolina, Georgia, and Texas, U.S.A. In the eastern North Atlantic, nesting has been reported in Mauritania (Fretey 2001).

The complete nesting range of NA DPS green sea turtles within the southeastern United States includes sandy beaches between Texas and North Carolina, as well as Puerto Rico (Dow et al. 2007; NMFS and USFWS 1991). The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Johnson and Ehrhart 1994; Meylan et al. 1995). Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard south through Broward counties.

In U.S. Atlantic and Gulf of Mexico waters, green sea turtles are distributed throughout inshore and nearshore waters from Texas to Massachusetts. Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty 1984; Hildebrand 1982; Shaver 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon system in Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward Counties (Guseman and Ehrhart 1992; Wershoven and Wershoven 1992). The summer developmental habitat for green sea turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus 1997). Additional important foraging areas in the western Atlantic include the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean coast of Panama, scattered areas along Colombia and Brazil (Hirth 1971), and the northwestern coast of the Yucatán Peninsula.

South Atlantic DPS Distribution

The SA DPS boundary is shown in Figure 4, and includes the U.S. Virgin Islands in the Caribbean. The SA DPS nesting sites can be roughly divided into four regions: western Africa, Ascension Island, Brazil, and the South Atlantic Caribbean (including Colombia, the Guianas, and Aves Island in addition to the numerous small, island nesting sites).

The in-water range of the SA DPS is widespread. In the eastern South Atlantic, significant sea turtle habitats have been identified, including green turtle feeding grounds in Corisco Bay, Equatorial Guinea/Gabon (Formia 1999); Congo; Mussulo Bay, Angola (Carr and Carr 1991); as well as Principe Island. Juvenile and adult green turtles utilize foraging areas throughout the Caribbean areas of the South Atlantic, often resulting in interactions with fisheries occurring in those same waters (Dow et al. 2007). Juvenile green turtles from multiple rookeries also frequently utilize the nearshore waters off Brazil as foraging grounds as evidenced from the frequent captures by fisheries (Lima et al. 2010; López-Barrera et al. 2012; Marcovaldi et al. 2009). Genetic analysis of green turtles on the foraging grounds off Ubatuba and Almofala, Brazil show mixed stocks coming primarily from Ascension, Suriname and Trindade as a secondary source, but also Aves, and even sometimes Costa Rica (North Atlantic DPS)(Naro-Maciel et al. 2007; Naro-Maciel et al. 2012). While no nesting occurs as far south as Uruguay and Argentina, both have important foraging grounds for South Atlantic green turtles (Gonzalez Carman et al. 2011; Lezama 2009; López-Mendilaharsu et al. 2006; Prosdocimi et al. 2012; Rivas-Zinno 2012).

Life History Information

Green sea turtles reproduce sexually, and mating occurs in the waters off nesting beaches and along migratory routes. Mature females return to their natal beaches (i.e., the same beaches where they were born) to lay eggs (Balazs 1982; Frazer and Ehrhart 1985) every 2-4 years while males are known to reproduce every year (Balazs 1983). In the southeastern United States, females generally nest between June and September, and peak nesting occurs in June and July (Witherington and Ehrhart 1989b). During the nesting season, females nest at approximately 2-week intervals, laying an average of 3-4 clutches (Johnson and Ehrhart 1996). Clutch size often varies among subpopulations, but mean clutch size is approximately 110-115 eggs. In Florida, green sea turtle nests contain an average of 136 eggs (Witherington and Ehrhart 1989b). Eggs incubate for approximately 2 months before hatching. Hatchling green sea turtles are approximately 2 in (5 cm) in length and weigh approximately 0.9 ounces (25 grams). Survivorship at any particular nesting site is greatly influenced by the level of man-made stressors, with the more pristine and less disturbed nesting sites (e.g., along the Great Barrier Reef in Australia) showing higher survivorship values than nesting sites known to be highly disturbed (e.g., Nicaragua) (Campell and Lagueux 2005; Chaloupka and Limpus 2005).

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

While in coastal habitats, green sea turtles exhibit site fidelity to specific foraging and nesting grounds, and it is clear they are capable of “homing in” on these sites if displaced (McMichael et al. 2003). Reproductive migrations of Florida green sea turtles have been identified through flipper tagging and/or satellite telemetry. Based on these studies, the majority of adult female Florida green sea turtles are believed to reside in nearshore foraging areas throughout the Florida Keys and in the waters southwest of Cape Sable, and some post-nesting turtles also reside in Bahamian waters as well (NMFS and USFWS 2007a).

Status and Population Dynamics

Accurate population estimates for marine turtles do not exist because of the difficulty in sampling turtles over their geographic ranges and within their marine environments. Nonetheless, researchers have used nesting data to study trends in reproducing sea turtles over time. A summary of nesting trends and nester abundance is provided in the most recent status review for the species (Seminoff et al. 2015), with information for each of the DPSs.

<u>North Atlantic DPS</u>

The NA DPS is the largest of the 11 green turtle DPSs, with an estimated nester abundance of over 167,000 adult females from 73 nesting sites. Overall this DPS is also the most data rich. Eight of the sites have high levels of abundance (i.e., < 1000 nesters), located in Costa Rica, Cuba, Mexico, and Florida. All major nesting populations demonstrate long-term increases in abundance (Seminoff et al. 2015).

Tortuguero, Costa Rica is by far the predominant nesting site, accounting for an estimated 79% of nesting for the DPS (Seminoff et al. 2015). Nesting at Tortuguero appears to have been increasing since the 1970s, when monitoring began. For instance, from 1971-1975 there were approximately 41,250 average annual emergences documented and this number increased to an average of 72,200 emergences from 1992-1996 (Bjorndal et al. 1999). Troëng and Rankin (2005) collected nest counts from 1999-2003 and also reported increasing trends in the population consistent with the earlier studies, with nest count data suggesting 17,402-37,290 nesting females per year (NMFS and USFWS 2007a). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Tortuguero, Costa Rica population's growing at 4.9% annually.

In the continental United States, green sea turtle nesting occurs along the Atlantic coast, primarily along the central and southeast coast of Florida where an estimated 200-1,100 females nest each year (Meylan et al. 1994; Weishampel et al. 2003). Occasional nesting has also been documented along the Gulf Coast of Florida (Meylan et al. 1995). Green sea turtle nesting is documented annually on beaches of North Carolina, South Carolina, and Georgia, though nesting is found in low quantities (nesting databases maintained on www.seaturtle.org).

In Florida, index beaches were established to standardize data collection methods and effort on key nesting beaches. Since establishment of the index beaches in 1989, the pattern of green sea turtle nesting has generally shown biennial peaks in abundance with a positive trend during the 10 years of regular monitoring (Figure 5). According to data collected from Florida's index nesting beach survey from 1989-2015, green sea turtle nest counts across Florida have increased approximately ten-fold from a low of 267 in the early 1990s to a high of 27,975 in 2015. Two consecutive years of nesting declines in 2008 and 2009 caused some concern, but this was followed by increases in 2010 and 2011, and a return to the trend of biennial peaks in abundance thereafter (Figure 5). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more has resulted in an estimate of the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9%.

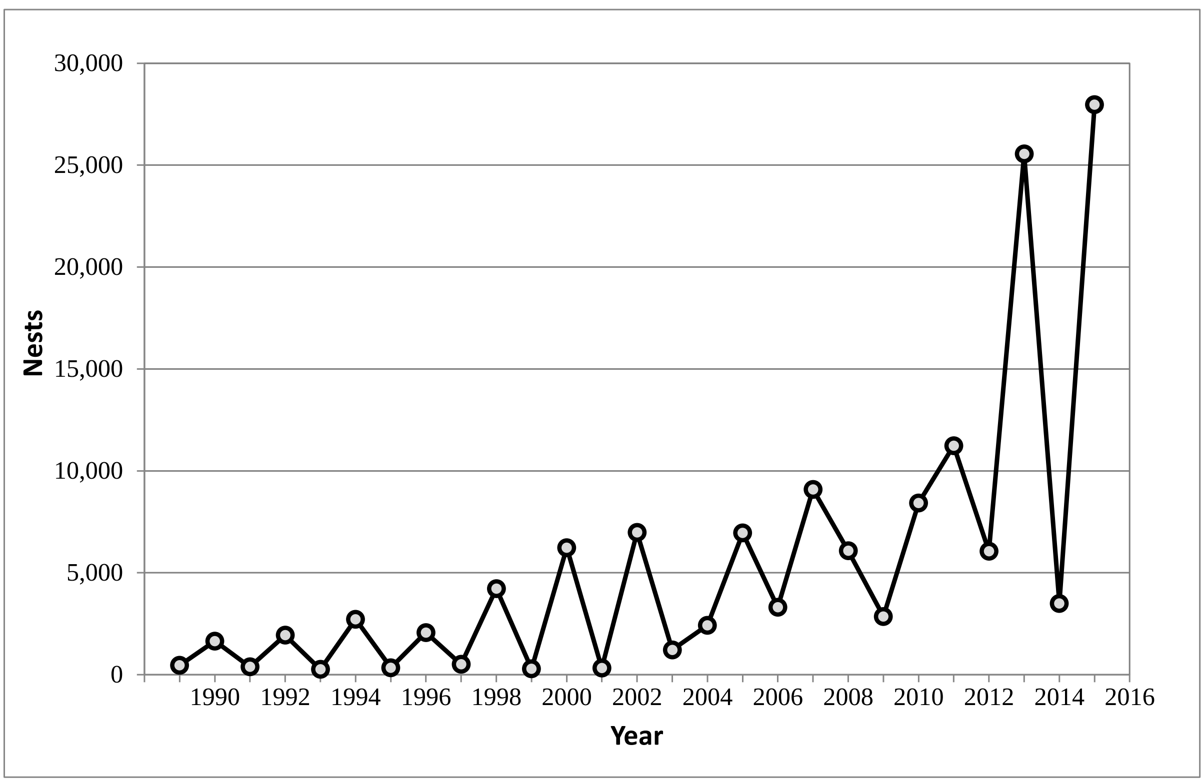

Figure 5. Green sea turtle nesting at Florida index beaches since 1989

Similar to the nesting trend found in Florida, in-water studies in Florida have also recorded increases in green turtle captures at the Indian River Lagoon site, with a 661 percent increase over 24 years (Ehrhart et al. 2007), and the St Lucie Power Plant site, with a significant increase in the annual rate of capture of immature green turtles (SCL < 90 cm) from 1977 to 2002 or 26 years (3,557 green turtles total; M. Bressette, Inwater Research Group, unpubl. Data) (Witherington et al. 2006).

South Atlantic DPS

The SA DPS is large, estimated at over 63,000 nesters, but data availability is poor. More than half of the 51 identified nesting sites (37) did not have sufficient data to estimate number of nesters or trends (Seminoff et al. 2015). This includes some sites, such as beaches in French Guiana, which are suspected to have large numbers of nesters. Therefore, while the estimated number of nesters may be substantially underestimated, we also do not know the population trends at those data-poor beaches. However, while the lack of data was a concern due to increased uncertainty, the overall trend of the SA DPS was not considered to be a major concern as some of the largest nesting beaches such as Ascension Island, Aves Island (Venezuela), and Galibi (Suriname) appear to be increasing. Others such as Trindade (Brazil), Atol das Rocas (Brazil), and Poilão and the rest of Guinea-Bissau seem to be stable or do not have sufficient data to make a determination. Bioko (Equatorial Guinea) appears to be in decline but has less nesting than the other primary sites (Seminoff et al. 2015).

In the U.S., nesting of SA DPS green turtles occurs on the beaches of the U.S. Virgin Islands, primarily on Buck Island. There is insufficient data to determine a trend for Buck Island nesting, and it is a smaller rookery, with approximately 63 total nesters utilizing the beach (Seminoff et al. 2015).

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of the species for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U.S. jurisdiction, where exploitation is still a threat. Green sea turtles also face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (e.g., plastics, petroleum products, petrochemicals), ecosystem alterations (e.g., nesting beach development, beach nourishment and shoreline stabilization, vegetation changes), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 4.2.1.

In addition to general threats, green sea turtles are susceptible to natural mortality from Fibropapillomatosis (FP) disease. FP results in the growth of tumors on soft external tissues (flippers, neck, tail, etc.), the carapace, the eyes, the mouth, and internal organs (gastrointestinal tract, heart, lungs, etc.) of turtles (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). These tumors range in size from 0.04 in (0.1 cm) to greater than 11.81 in (30 cm) in diameter and may affect swimming, vision, feeding, and organ function (Aguirre et al. 2002; Herbst 1994;

Jacobson et al. 1989). Presently, scientists are unsure of the exact mechanism causing this disease, though it is believed to be related to both an infectious agent, such as a virus (Herbst et al. 1995), and environmental conditions (e.g., habitat degradation, pollution, low wave energy, and shallow water (Foley et al. 2005). FP is cosmopolitan, but it has been found to affect large numbers of animals in specific areas, including Hawaii and Florida (Herbst 1994; Jacobson 1990; Jacobson et al. 1991).

Cold-stunning is another natural threat to green sea turtles. Although it is not considered a major source of mortality in most cases, as temperatures fall below 46.4°-50°F (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 1989a). 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, and hundreds found dead or dying. A large cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1,650 green sea turtles found cold-stunned in Texas. Of these, approximately 620 were found dead or died after stranding, while approximately 1,030 turtles were rehabilitated and released. During this same time frame, approximately 340 green sea turtles were found cold-stunned in Mexico, though approximately 300 of those were subsequently rehabilitated and released.

Whereas oil spill impacts are discussed generally for all species in Section 4.2.1, specific impacts of the DWH spill on green sea turtles are considered here. Impacts to green sea turtles occurred to offshore small juveniles only. A total of 154,000 small juvenile greens (36.6% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. A large number of small juveniles were removed from the population, as 57,300 small juveniles greens are estimated to have died as a result of the exposure. A total of 4 nests (580 eggs) were also translocated during response efforts, with 455 hatchlings released (the fate of which is unknown) (DWH Trustees 2015). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

While green turtles regularly use the northern Gulf of Mexico, they have a widespread distribution throughout the entire Gulf of Mexico, Caribbean, and Atlantic, and the proportion of the population using the northern Gulf of Mexico at any given time is relatively low. Although it is known that adverse impacts occurred and numbers of animals in the Gulf of Mexico were reduced as a result of the DWH oil spill of 2010, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event, as well as the impacts being primarily to smaller juveniles (lower reproductive value than adults and large juveniles), reduces the impact to the overall population. It is unclear what impact these losses may have caused on a population level, but it is not expected to have had a large impact on the population trajectory moving forward. However, recovery of green turtle numbers equivalent to what was lost in the northern Gulf of Mexico as a result of the spill will likely take decades of sustained efforts to reduce the existing threats and enhance survivorship of multiple life stages (DWH Trustees 2015).

4.4 Kemp's Ridley Sea Turtle

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

Species Description and Distribution

The Kemp's ridley sea turtle is the smallest of all sea turtles. Adults generally weigh less than 100 lb (45 kg) and have a carapace length of around 2.1 ft (65 cm). Adult Kemp's ridley shells are almost as wide as they are long. Coloration changes significantly during development from the grey-black dorsum and plastron of hatchlings, a grey-black dorsum with a yellowish-white plastron as post-pelagic juveniles, and then to the lighter grey-olive carapace and cream-white or yellowish plastron of adults. There are 2 pairs of prefrontal scales on the head, 5 vertebral scutes, usually 5 pairs of costal scutes, and generally 12 pairs of marginal scutes on the carapace. In each bridge adjoining the plastron to the carapace, there are 4 scutes, each of which is perforated by a pore.

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

The primary range of Kemp's ridley sea turtles is within the Gulf of Mexico basin, though they also occur in coastal and offshore waters of the U.S. Atlantic Ocean. Juvenile Kemp's ridley sea turtles, possibly carried by oceanic currents, have been recorded as far north as Nova Scotia. Historic records indicate a nesting range from Mustang Island, Texas, in the north to Veracruz, Mexico, in the south. Kemp's ridley sea turtles have recently been nesting along the Atlantic Coast of the United States, with nests recorded from beaches in Florida, Georgia, and the Carolinas. In 2012, the first Kemp's ridley sea turtle nest was recorded in Virginia. The Kemp's ridley nesting population had been exponentially increasing prior to the recent low nesting years, which may indicate that the population had been experiencing a similar increase. Additional nesting data in the coming years will be required to determine what the recent nesting decline means for the population trajectory.

Life History Information

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

The average rates of growth may vary by location, but generally fall within 2.2-2.9 ± 2.4 in per year (5.5-7.5 ± 6.2 cm/year) (Schmid and Barichivich 2006; Schmid and Woodhead 2000). Age to sexual maturity ranges greatly from 5-16 years, though NMFS et al. (2011) determined the best estimate of age to maturity for Kemp's ridley sea turtles was 12 years. It is unlikely that most adults grow very much after maturity. While some sea turtles nest annually, the weighted mean remigration rate for Kemp's ridley sea turtles is approximately 2 years. Nesting generally occurs from April to July. Females lay approximately 2.5 nests per season with each nest containing approximately 100 eggs (Márquez M. 1994).

Population Dynamics

Of the 7 species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the beaches of Rancho Nuevo, Mexico (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s, however, nesting numbers from Rancho Nuevo and adjacent Mexican beaches were below 1,000, with a low of 702 nests in 1985. Yet, nesting steadily increased through the 1990s, and then accelerated during the first decade of the twenty-first century (Figure 6), which indicates the species is recovering.

It is worth noting that when the Bi-National Kemp's Ridley Sea Turtle Population Restoration Project was initiated in 1978, only Rancho Nuevo nests were recorded. In 1988, nesting data from southern beaches at Playa Dos and Barra del Tordo were added. In 1989, data from the northern beaches of Barra Ostionales and Tepehuajes were added, and most recently in 1996, data from La Pesca and Altamira beaches were recorded. Currently, nesting at Rancho Nuevo accounts for just over 81% of all recorded Kemp's ridley nests in Mexico. Following a significant, unexplained 1-year decline in 2010, Kemp's ridley nests in Mexico reached a record high of 21,797 in 2012 (Gladys Porter Zoo 2013). From 2013 through 2014, there was a second significant decline, as only 16,385 and 11,279 nests were recorded, respectively. In 2015, nesting in Mexico improved to 14,006 recorded nests (J. Pena, Gladys Porter Zoo, pers. comm. to M. Barnette, NMFS PRD, October 19, 2015). At this time, it is unclear if future nesting will steadily and continuously increase, similar to what occurred from 1990-2009, or if nesting will continue to exhibit sporadic declines and increases as recorded in the past 5 years.

A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 42 in 2004, to a record high of 209 nests in 2012 (National Park Service data, http://www.nps.gov/pais/naturescience/strp.htm, http://www.nps.gov/pais/naturescience/current-season.htm). It is worth noting that nesting in Texas has paralleled the trends observed in Mexico, with a significant decline in 2010 followed by a second decline in 2013-2014. Nesting rebounded in 2015, as 159 nests were documented along the Texas coast (D. Shaver, National Park Service, pers. comm. to M. Barnette, NMFS PRD, October 28, 2015).

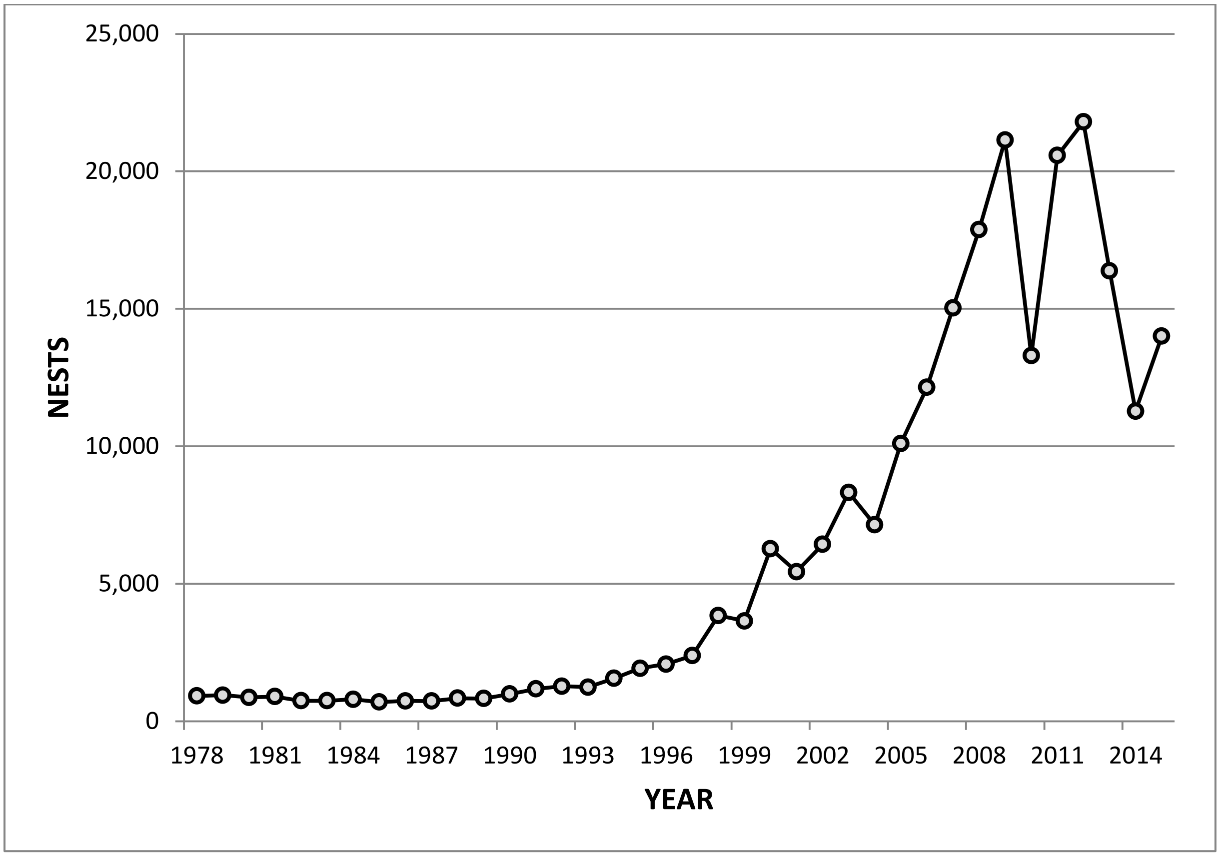

Figure 6. Kemp's ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2015)

Through modelling, Heppell et al. (2005) predicted the population is expected to increase at least 12-16% per year and could reach at least 10,000 females nesting on Mexico beaches by 2015. NMFS et al. (2011) produced an updated model that predicted the population to increase 19% per year and to attain at least 10,000 females nesting on Mexico beaches by 2011. Approximately 25,000 nests would be needed for an estimate of 10,000 nesters on the beach, based on an average 2.5 nests/nesting female. While counts did not reach 25,000 nests by 2015, it is clear that the population has increased over the long term. The increases in Kemp's ridley sea turtle nesting over the last 2 decades is likely due to a combination of management measures including elimination of direct harvest, nest protection, the use of TEDs, reduced trawling effort in Mexico and the United States, and possibly other changes in vital rates (TEWG 1998; TEWG 2000). While these results are encouraging, the species' limited range as well as low global abundance makes it particularly vulnerable to new sources of mortality as well as demographic and environmental randomness, all factors which are often difficult to predict with any certainty. Additionally, the significant nesting declines observed in 2010 and 2013-2014 potentially indicate a serious population-level impact, and there is cause for concern regarding the ongoing recovery trajectory.

Threats

Kemp's ridley sea turtles face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 4.2.1; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact Kemp's ridley sea turtles.

As Kemp's ridley sea turtles continue to recover and nesting arribadas[2] are increasingly established, bacterial and fungal pathogens in nests are also likely to increase. Bacterial and fungal pathogen impacts have been well documented in the large arribadas of the olive ridley at Nancite in Costa Rica (Mo 1988). In some years, and on some sections of the beach, the hatching success can be as low as 5% (Mo 1988). As the Kemp's ridley nest density at Rancho Nuevo and adjacent beaches continues to increase, appropriate monitoring of emergence success will be necessary to determine if there are any density-dependent effects.

Over the past 6 years, NMFS has documented (via the Sea Turtle Stranding and Salvage Network [STSSN] data, http://www.sefsc.noaa.gov/species/turtles/strandings.htm) elevated sea turtle strandings in the Northern Gulf of Mexico, particularly throughout the Mississippi Sound area. In the first 3 weeks of June 2010, over 120 sea turtle strandings were reported from Mississippi and Alabama waters, none of which exhibited any signs of external oiling to indicate effects associated with the DWH oil spill event. A total of 644 sea turtle strandings were reported in 2010 from Louisiana, Mississippi, and Alabama waters, 561 (87%) of which were Kemp's ridley sea turtles. During March through May of 2011, 267 sea turtle strandings were reported from Mississippi and Alabama waters alone. A total of 525 sea turtle strandings were reported in 2011 from Louisiana, Mississippi, and Alabama waters, with the majority (455) having occurred from March through July, 390 (86%) of which were Kemp's ridley sea turtles. During 2012, a total of 384 sea turtles were reported from Louisiana, Mississippi, and Alabama waters. Of these reported strandings, 343 (89%) were Kemp's ridley sea turtles. During 2014, a total of 285 sea turtles were reported from Louisiana, Mississippi, and Alabama waters, though the data is incomplete. Of these reported strandings, 229 (80%) were Kemp's ridley sea turtles. These stranding numbers are significantly greater than reported in past years; Louisiana, Mississippi, and Alabama waters reported 42 and 73 sea turtle strandings for 2008 and 2009, respectively. It should be noted that stranding coverage has increased considerably due to the DWH oil spill event.

Nonetheless, considering that strandings typically represent only a small fraction of actual mortality, these stranding events potentially represent a serious impact to the recovery and survival of the local sea turtle populations. While a definitive cause for these strandings has not been identified, necropsy results indicate a significant number of stranded turtles from these events likely perished due to forced submergence, which is commonly associated with fishery interactions (B. Stacy, NMFS, pers. comm. to M. Barnette, NMFS PRD, March 2012). Yet, available information indicates fishery effort was extremely limited during the stranding events. The fact that 80% or more of all Louisiana, Mississippi, and Alabama stranded sea turtles in the past 5 years were Kemp's ridleys is notable; however, this could simply be a function of the

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

species' preference for shallow, inshore waters coupled with increased population abundance, as reflected in recent Kemp's ridley nesting increases.

In response to these strandings, and due to speculation that fishery interactions may be the cause, fishery observer effort was shifted to evaluate the inshore skimmer trawl fishery during the summer of 2012. During May-July of that year, observers reported 24 sea turtle interactions in the skimmer trawl fishery. All but a single sea turtle were identified as Kemp's ridleys (1 sea turtle was an unidentified hardshell turtle). Encountered sea turtles were all very small juvenile specimens, ranging from 7.6-19.0 in (19.4-48.3 cm) curved carapace length (CCL). All sea turtles were released alive. The small average size of encountered Kemp's ridleys introduces a potential conservation issue, as over 50% of these reported sea turtles could potentially pass through the maximum 4-in bar spacing of TEDs currently required in the shrimp fishery. Due to this issue, a proposed 2012 rule to require TEDs in the skimmer trawl fishery (77 FR 27411) was not implemented. Based on anecdotal information, these interactions were a relatively new issue for the inshore skimmer trawl fishery. Given the nesting trends and habitat utilization of Kemp's ridley sea turtles, it is likely that fishery interactions in the Northern Gulf of Mexico may continue to be an issue of concern for the species, and one that may potentially slow the rate of recovery for Kemp's ridley sea turtles.

While oil spill impacts are discussed generally for all species in Section 4.2.1, specific impacts of the DWH oil spill event on Kemp's ridley sea turtles are considered here. Kemp's ridleys experienced the greatest negative impact stemming from the DWH oil spill event of any sea turtle species. Impacts to Kemp's ridley sea turtles occurred to offshore small juveniles, as well as large juveniles and adults. Loss of hatchling production resulting from injury to adult turtles was also estimated for this species. Injuries to adult turtles of other species, such as loggerheads, certainly would have resulted in unrealized nests and hatchlings to those species as well. Yet, the calculation of unrealized nests and hatchlings was limited to Kemp's ridleys for several reasons. All Kemp's ridleys in the Gulf belong to the same population (NMFS et al. 2011), so total population abundance could be calculated based on numbers of hatchlings because all individuals that enter the population could reasonably be expected to inhabit the northern Gulf of Mexico throughout their lives (DWH Trustees 2015).

A total of 217,000 small juvenile Kemp's ridleys (51.5% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. That means approximately half of all small juvenile Kemp's ridleys from the total population estimate of 430,000 oceanic small juveniles were exposed to oil. Furthermore, a large number of small juveniles were removed from the population, as up to 90,300 small juveniles Kemp's ridleys are estimated to have died as a direct result of the exposure. Therefore, as much as 20% of the small oceanic juveniles of this species were killed during that year. Impacts to large juveniles (>3 years old) and adults were also high. An estimated 21,990 such individuals were exposed to oil (about 22% of the total estimated population for those age classes); of those, 3,110 mortalities were estimated (or 3% of the population for those age classes). The loss of near-reproductive and reproductive-stage females would have contributed to some extent to the decline in total nesting abundance observed between 2011 and 2014. The estimated number of unrealized Kemp's ridley nests is between 1,300 and 2,000, which translates to between approximately 65,000 and 95,000 unrealized hatchlings (DWH Trustees 2015). This is a minimum estimate, however, because the sublethal effects of the DWH oil spill event on turtles, their prey, and their habitats might have delayed or reduced reproduction in subsequent years, which may have contributed substantially to additional nesting deficits observed following the DWH oil spill event. These sublethal effects could have slowed growth and maturation rates, increased remigration intervals, and decreased clutch frequency (number of nests per female per nesting season). The nature of the DWH oil spill event effect on reduced Kemp's ridley nesting abundance and associated hatchling production after 2010 requires further evaluation. It is clear that the DWH oil spill event resulted in large losses to the Kemp's ridley population across various age classes, and likely had an important population-level effect on the species. Still, we do not have a clear understanding of those impacts on the population trajectory for the species into the future.

4.5 Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its entire range on June 2, 1970, (35 FR 8491) under the Endangered Species Conservation Act of 1969.

Species Description and Distribution

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

Unlike other sea turtles, leatherbacks have several unique traits that enable them to live in cold water. For example, leatherbacks have a countercurrent circulatory system (Greer et al. 1973),[3] a thick layer of insulating fat (Davenport et al. 1990; Goff and Lien 1988), gigantothermy (Paladino et al. 1990),[4] and they can increase their body temperature through increased metabolic activity (Bostrom and Jones 2007; Southwood et al. 2005). These adaptations allow leatherbacks to be comfortable in a wide range of temperatures, which helps them to travel further than any other sea turtle species (NMFS and USFWS 1995). For example, a leatherback may swim more than 6,000 miles (10,000 km) in a single year (Benson et al. 2007a; Benson et al. 2011; Eckert 2006; Eckert et al. 2006). They search for food between latitudes 71°N and 47°S in all oceans, and travel extensively to and from their tropical nesting beaches. In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS 2001).

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[3] Countercurrent circulation is a highly efficient means of minimizing heat loss through the skin's surface because heat is recycled. For example, a countercurrent circulation system often has an artery containing warm blood from the heart surrounded by a bundle of veins containing cool blood from the body's surface. As the warm blood flows away from the heart, it passes much of its heat to the colder blood returning to the heart via the veins. This conserves heat by recirculating it back to the body's core.

[4] "Gigantothermy" refers to a condition when an animal has relatively high volume compared to its surface area, and as a result, it loses less heat.

While leatherbacks will look for food in coastal waters, they appear to prefer the open ocean at all life stages (Heppell et al. 2003b). Leatherbacks have pointed tooth-like cusps and sharp-edged jaws that are adapted for a diet of soft-bodied prey such as jellyfish and salps. A leatherback's mouth and throat also have backward-pointing spines that help retain jelly-like prey. Leatherbacks' favorite prey are jellies (e.g., medusae, siphonophores, and salps), which commonly occur in temperate and northern or sub-arctic latitudes and likely has a strong influence on leatherback distribution in these areas (Plotkin 2003). Leatherbacks are known to be deep divers, with recorded depths in excess of a half-mile (Eckert et al. 1989), but they may also come into shallow waters to locate prey items.

Genetic analyses using microsatellite markers along with mitochondrial DNA and tagging data indicate there are 7 groups or breeding populations in the Atlantic Ocean: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG 2007). General differences in migration patterns and foraging grounds may occur between the 7 nesting assemblages, although data to support this is limited in most cases.

Life History Information

The leatherback life cycle is broken into several stages: (1) egg/hatchling, (2) post-hatchling, (3) juvenile, (4) subadult, and (5) adult. Leatherbacks are a long-lived species that delay age of maturity, have low and variable survival in the egg and juvenile stages, and have relatively high and constant annual survival in the subadult and adult life stages (Chaloupka 2002; Crouse 1999; Heppell et al. 1999; Heppell et al. 2003b; Spotila et al. 1996; Spotila et al. 2000). While a robust estimate of the leatherback sea turtle's life span does not exist, the current best estimate for the maximum age is 43 (Avens et al. 2009). It is still unclear when leatherbacks first become sexually mature. Using skeletochronological data, Avens et al. (2009) estimated that leatherbacks in the western North Atlantic may not reach maturity until 29 years of age, which is longer than earlier estimates of 2-3 years by Pritchard and Trebbau (1984), of 3-6 years by Rhodin (1985), of 13-14 years for females by Zug and Parham (1996), and 12-14 years for leatherbacks nesting in the U.S. Virgin Islands by Dutton et al. (2005). A more recent study that examined leatherback growth rates estimated an age at maturity of 16.1 years (Jones et al. 2011).

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

Female leatherbacks typically nest on sandy, tropical beaches at intervals of 2-4 years (Garcia M. and Sarti 2000; McDonald and Dutton 1996; Spotila et al. 2000). Unlike other sea turtle species, female leatherbacks do not always nest at the same beach year after year; some females may even nest at different beaches during the same year (Dutton et al. 2005; Eckert 1989; Keinath and Musick 1993; Steyermark et al. 1996). Individual female leatherbacks have been observed with fertility spans as long as 25 years (Hughes 1996). Females usually lay up to 10 nests during the 3-6 month nesting season (March through July in the United States), typically 8-12 days apart, with 100 eggs or more per nest (Eckert et al. 2012; Eckert 1989; Maharaj 2004; Matos 1986; Stewart and Johnson 2006; Tucker 1988). Yet, up to approximately 30% of the eggs may be infertile (Eckert 1989; Eckert et al. 1984; Maharaj 2004; Matos 1986; Stewart and Johnson

2006; Tucker 1988). The number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergent success) is approximately 50% worldwide (Eckert et al. 2012), which is lower than the greater than 80% reported for other sea turtle species (Miller 1997). In the United States, the emergent success is higher at 54-72% (Eckert and Eckert 1990; Stewart and Johnson 2006; Tucker 1988). Thus the number of hatchlings in a given year may be less than the total number of eggs produced in a season. Eggs hatch after 60-65 days, and the hatchlings have white striping along the ridges of their backs and on the edges of the flippers. Leatherback hatchlings weigh approximately 1.5-2 oz (40-50 g), and have lengths of approximately 2-3 in (51-76 mm), with fore flippers as long as their bodies. Hatchlings grow rapidly, with reported growth rates for leatherbacks from 2.5-27.6 in (6-70 cm) in length, estimated at 12.6 in (32 cm) per year (Jones et al. 2011).

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

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

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

Status and Population Dynamics

The status of the Atlantic leatherback population has been less clear than the Pacific population, which has shown dramatic declines at many nesting sites (Santidrián Tomillo et al. 2007; Sarti Martínez et al. 2007; Spotila et al. 2000). This uncertainty has been a result of inconsistent beach and aerial surveys, cycles of erosion, and reformation of nesting beaches in the Guianas (representing the largest nesting area). Leatherbacks also show a lesser degree of nest-site fidelity than occurs with the hardshell sea turtle species. Coordinated efforts of data collection and analyses by the leatherback Turtle Expert Working Group have helped to clarify the understanding of the Atlantic population status (TEWG 2007).

The Southern Caribbean/Guianas stock is the largest known Atlantic leatherback nesting aggregation (TEWG 2007). This area includes the Guianas (Guyana, Suriname, and French Guiana), Trinidad, Dominica, and Venezuela, with most of the nesting occurring in the Guianas and Trinidad. The Southern Caribbean/Guianas stock of leatherbacks was designated after genetics studies indicated that animals from the Guianas (and possibly Trinidad) should be viewed as a single population. Using nesting females as a proxy for population, the TEWG (2007) determined that the Southern Caribbean/Guianas stock had demonstrated a long-term, positive population growth rate. TEWG observed positive growth within major nesting areas for the stock, including Trinidad, Guyana, and the combined beaches of Suriname and French Guiana (TEWG 2007). More specifically, Tiwari et al. (2013) report an estimated three-generation abundance change of +3%, +20,800%, +1,778%, and +6% in Trinidad, Guyana, Suriname, and French Guiana, respectively.

Researchers believe the cyclical pattern of beach erosion and then reformation has affected leatherback nesting patterns in the Guianas. For example, between 1979 and 1986, the number of leatherback nests in French Guiana had increased by about 15% annually (NMFS 2001). This increase was then followed by a nesting decline of about 15% annually. This decline corresponded with the erosion of beaches in French Guiana and increased nesting in Suriname. This pattern suggests that the declines observed since 1987 might actually be a part of a nesting cycle that coincides with cyclic beach erosion in Guiana (Schulz 1975). Researchers think that the cycle of erosion and reformation of beaches may have changed where leatherbacks nest throughout this region. The idea of shifting nesting beach locations was supported by increased nesting in Suriname,[5] while the number of nests was declining at beaches in Guiana (Hilterman et al. 2003). Though this information suggested the long-term trend for the overall Suriname and French Guiana population was increasing.

The Western Caribbean stock includes nesting beaches from Honduras to Colombia. Across the Western Caribbean, nesting is most prevalent in Costa Rica, Panama, and the Gulf of Uraba in Colombia (Duque et al. 2000). The Caribbean coastline of Costa Rica and extending through Chiriquí Beach, Panama, represents the fourth largest known leatherback rookery in the world (Troëng et al. 2004). Examination of data from index nesting beaches in Tortuguero, Gandoca, and Pacuaré in Costa Rica indicate that the nesting population likely was not growing over the 1995-2005 time series (TEWG 2007). Other modeling of the nesting data for Tortuguero indicates a possible 67.8% decline between 1995 and 2006 (Troëng et al. 2007). Tiwari et al. (2013) report an estimated three-generation abundance change of -72%, -24%, and +6% for Tortuguero, Gandoca, and Pacuare, respectively.

Nesting data for the Northern Caribbean stock is available from Puerto Rico, St. Croix (U.S. Virgin Islands), and the British Virgin Islands (Tortola). In Puerto Rico, the primary nesting beaches are at Fajardo and on the island of Culebra. Nesting between 1978 and 2005 has ranged

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

between 469-882 nests, and the population has been growing since 1978, with an overall annual growth rate of 1.1% (TEWG 2007). Tiwari et al. (2013) report an estimated three-generation abundance change of -4% and +5,583% at Culebra and Fajardo, respectively. At the primary nesting beach on St. Croix, the Sandy Point National Wildlife Refuge, nesting has varied from a few hundred nests to a high of 1,008 in 2001, and the average annual growth rate has been approximately 1.1% from 1986-2004 (TEWG 2007). From 2006-2010, Tiwari et al. (2013) report an annual growth rate of +7.5% in St. Croix and a 3-generation abundance change of +1,058%. Nesting in Tortola is limited, but has been increasing from 0-6 nests per year in the late 1980s to 35-65 per year in the 2000s, with an annual growth rate of approximately 1.2% between 1994 and 2004 (TEWG 2007).

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800-900 per year in the 2000s following nesting totals fewer than 100 nests per year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the index nesting beach surveys, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17% between 1989 and 2005. FWC Index Nesting Beach Survey Data generally indicates biennial peaks in nesting abundance beginning in 2007 (Figure 7 and Table 6). A similar pattern was also observed statewide (Table 6). This up-and-down pattern is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting. Overall, the trend shows growth on Florida's east coast beaches. Tiwari et al. (2013) report an annual growth rate of 9.7% and a 3-generation abundance change of +1,863%.

Table 6. Number of Leatherback Sea Turtle Nests in Florida

Nests Recorded	**2011**	**2012**	**2013**	**2014**	**2015**
Index Nesting Beaches	625	515	322	641	489
Statewide	1,653	1,712	896	1,604	NA

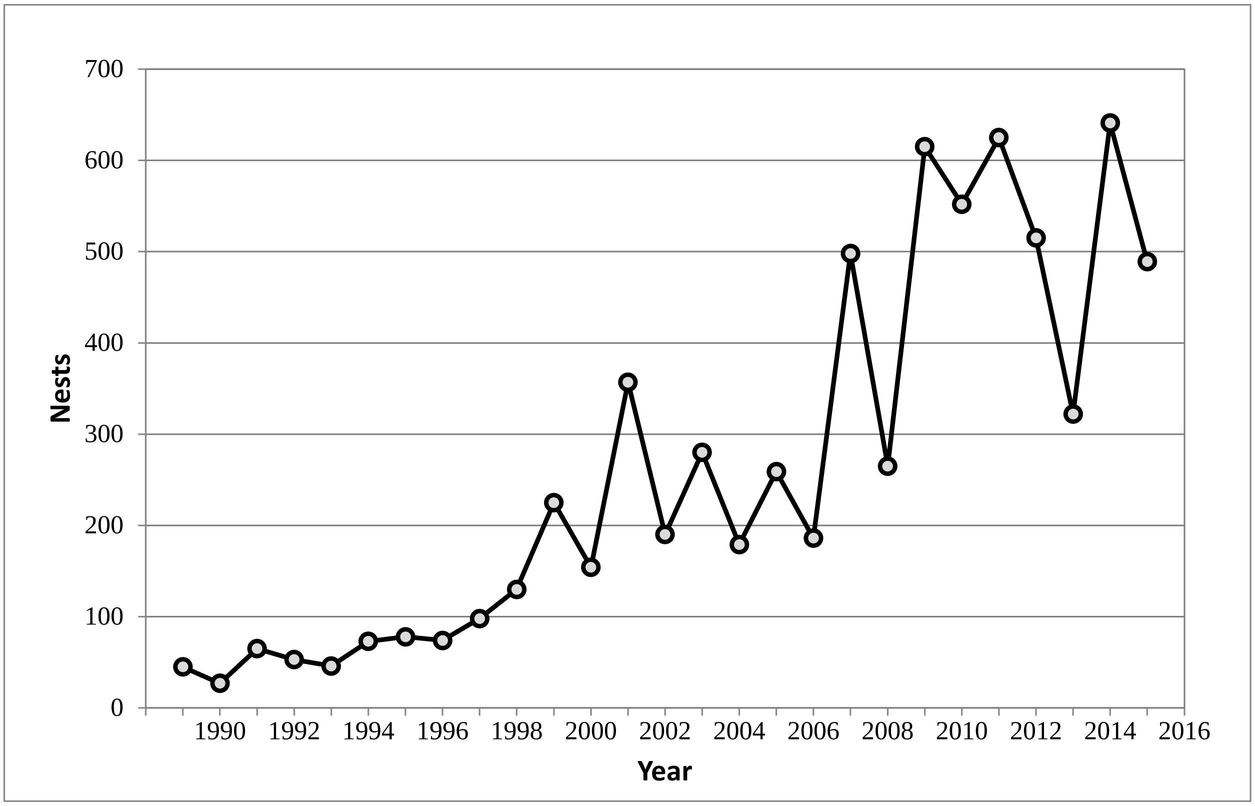

Figure 7. Leatherback sea turtle nesting at Florida index beaches since 1989

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

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

Because the available nesting information is inconsistent, it is difficult to estimate the total population size for Atlantic leatherbacks. Spotila et al. (1996) characterized the entire Western Atlantic population as stable at best and estimated a population of 18,800 nesting females. Spotila et al. (1996) further estimated that the adult female leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, was about 27,600 (considering both nesting and interesting females), with an estimated range of 20,082-35,133. This is consistent with the estimate of 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) determined by the TEWG (2007). The TEWG (2007) also determined that at of the time of their publication, leatherback sea turtle populations in the Atlantic were all stable or increasing with the exception of the Western Caribbean and West Africa populations. The latest review by NMFS USFWS (2013) suggests the leatherback nesting population is stable in most nesting regions of the Atlantic Ocean.

Threats

Leatherbacks face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 4.2.1; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact leatherback sea turtles.

Of all sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, especially gillnet and pot/trap lines. This vulnerability may be because of their body type (large size, long pectoral flippers, and lack of a hard shell), their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, their method of locomotion, and/or their attraction to the lightsticks used to attract target species in longline fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine and many other stranded individuals exhibited evidence of prior entanglement (Dwyer et al. 2003). Zug and Parham (1996) point out that a combination of the loss of long-lived adults in fishery-related mortalities and a lack of recruitment from intense egg harvesting in some areas has caused a sharp decline in leatherback sea turtle populations. This represents a significant threat to survival and recovery of the species worldwide.

Leatherback sea turtles may also be more susceptible to marine debris ingestion than other sea turtle species due to their predominantly pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding and migratory purposes (Lutcavage et al. 1997; Shoop and Kenney 1992). The stomach contents of leatherback sea turtles revealed that a substantial percentage (33.8% or 138 of 408 cases examined) contained some form of plastic debris (Mrosovsky et al. 2009). Blocking of the gut by plastic to an extent that could have caused death was evident in 8.7% of all leatherbacks that ingested plastic (Mrosovsky et al. 2009). Mrosovsky et al. (2009) also note that in a number of cases, the ingestion of plastic may not cause death outright, but could cause the animal to absorb fewer nutrients from food, eat less in general, etc.– factors which could cause other adverse effects. The presence of plastic in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and forms of debris such a plastic bags (Mrosovsky et al. 2009). Balazs (1985) speculated that the plastic object might resemble a food item by its shape, color, size, or even movement as it drifts about, and therefore induce a feeding response in leatherbacks.

As discussed in Section 4.2.1, global climate change can be expected to have various impacts on all sea turtles, including leatherbacks. Global climate change is likely to also influence the distribution and abundance of jellyfish, the primary prey item of leatherbacks (NMFS and USFWS 2007d). Several studies have shown leatherback distribution is influenced by jellyfish abundance ((Houghton et al. 2006; Witt et al. 2007; Witt et al. 2006); however, more studies need to be done to monitor how changes to prey items affect distribution and foraging success of leatherbacks so population-level effects can be determined.

While oil spill impacts are discussed generally for all species in Section 4.2.1, specific impacts of the DWH oil spill on leatherback sea turtles are considered here. Available information indicates leatherback sea turtles (along with hawksbill turtles) were likely directly affected by the oil spill. Leatherbacks were documented in the spill area, but the number of affected leatherbacks was not estimated due to a lack of information compared to other species. But given that the northern Gulf of Mexico is important habitat for leatherback migration and foraging (TEWG 2007), and documentation of leatherbacks in the DWH oil spill zone during the spill period, it was concluded that leatherbacks were exposed to DWH oil, and some portion of those exposed leatherbacks likely died. Potential DWH-related impacts to leatherback sea turtles include direct oiling or contact with dispersants from surface and subsurface oil and dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred. Although adverse impacts likely occurred to leatherbacks, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event may be relatively low. Thus, a population-level impact may not have occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

4.6 Loggerhead Sea Turtle – Northwest Atlantic DPS

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. NMFS and USFWS published a Final Rule which designated 9 DPSs for loggerhead sea turtles (76 FR 58868, September 22, 2011, and effective October 24, 2011). This rule listed the following DPSs: (1) Northwest Atlantic Ocean (threatened), (2) Northeast Atlantic Ocean (endangered), (3) South Atlantic Ocean (threatened), (4) Mediterranean Sea (endangered), (5) North Pacific Ocean (endangered), (6) South Pacific Ocean (endangered), (7) North Indian Ocean (endangered), (8) Southeast Indo-Pacific Ocean (endangered), and (9) Southwest Indian Ocean (threatened). The Northwest Atlantic (NWA) DPS is the only one that occurs within the action area, and therefore it is the only one considered in this Opinion.

Species Description and Distribution
Loggerheads are large sea turtles. Adults in the southeast United States average about 3 ft (92 cm) long, measured as a straight carapace length (SCL), and weigh approximately 255 lb (116 kg) (Ehrhart and Yoder 1978). Adult and subadult loggerhead sea turtles typically have a light yellow plastron and a reddish brown carapace covered by non-overlapping scutes that meet along seam lines. They typically have 11 or 12 pairs of marginal scutes, 5 pairs of costals, 5 vertebrals, and a nuchal (precentral) scute that is in contact with the first pair of costal scutes (Dodd Jr. 1988).

The loggerhead sea turtle inhabits continental shelf and estuarine environments throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd Jr. 1988). Habitat uses within these areas vary by life stage. Juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd Jr. 1988). Subadult and adult loggerheads are primarily found in coastal waters and eat benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

The majority of loggerhead nesting occurs at the western rims of the Atlantic and Indian Oceans concentrated in the north and south temperate zones and subtropics (NRC 1990). For the NWA DPS, most nesting occurs along the coast of the United States, from southern Virginia to Alabama. Additional nesting beaches for this DPS are found along the northern and western Gulf of Mexico, eastern Yucatán Peninsula, at Cay Sal Bank in the eastern Bahamas (Addison 1997; Addison and Morford 1996), off the southwestern coast of Cuba (Moncada Gavilan 2001), and along the coasts of Central America, Colombia, Venezuela, and the eastern Caribbean Islands.

Non-nesting, adult female loggerheads are reported throughout the U.S. Atlantic, Gulf of Mexico, and Caribbean Sea. Little is known about the distribution of adult males who are seasonally abundant near nesting beaches. Aerial surveys suggest that loggerheads as a whole are distributed in U.S. waters as follows: 54% off the southeast U.S. coast, 29% off the northeast U.S. coast, 12% in the eastern Gulf of Mexico, and 5% in the western Gulf of Mexico (TEWG 1998).

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 5 western Atlantic subpopulations, divided geographically as follows: (1) a Northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29ºN; (2) a South Florida nesting subpopulation, occurring from 29°N on the east coast of the state to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez M. 1990; TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS 2001).

The recovery plan for the Northwest Atlantic population of loggerhead sea turtles concluded that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula. It also concluded that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the recovery plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are as follows: (1) the Northern Recovery Unit (Florida/Georgia border north through southern Virginia), (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida), (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida), (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas), and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 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.

Life History Information

The Northwest Atlantic Loggerhead Recovery Team defined the following 8 life stages for the loggerhead life cycle, which include the ecosystems those stages generally use: (1) egg (terrestrial zone), (2) hatchling stage (terrestrial zone), (3) hatchling swim frenzy and transitional stage (neritic zone[6]), (4) juvenile stage (oceanic zone), (5) juvenile stage (neritic zone), (6) adult stage (oceanic zone), (7) adult stage (neritic zone), and (8) nesting female (terrestrial zone) (NMFS and USFWS 2008). Loggerheads are long-lived animals. They reach sexual maturity between 20-38 years of age, although age of maturity varies widely among populations (Frazer and Ehrhart 1985; NMFS 2001). The annual mating season occurs from late March to early June, and female turtles lay eggs throughout the summer months. Females deposit an average of 4.1 nests within a nesting season (Murphy and Hopkins 1984), but an individual female only nests every 3.7 years on average (Tucker 2010). Each nest contains an average of 100-126 eggs (Dodd Jr. 1988) which incubate for 42-75 days before hatching (NMFS and USFWS 2008). Loggerhead hatchlings are 1.5-2 inches long and weigh about 0.7 oz (20 g).

As post-hatchlings, loggerheads hatched on U.S. beaches enter the “oceanic juvenile” life stage, migrating offshore and becoming associated with *Sargassum* habitats, driftlines, and other convergence zones (Carr 1986; Conant et al. 2009; Witherington 2002). Oceanic juveniles grow at rates of 1-2 inches (2.9-5.4 cm) per year (Bjorndal et al. 2003; Snover 2002) over a period as long as 7-12 years (Bolten et al. 1998) before moving to more coastal habitats. Studies have suggested that not all loggerhead sea turtles follow the model of circumnavigating the North Atlantic Gyre as pelagic juveniles, followed by permanent settlement into benthic environments (Bolten and Witherington 2003; Laurent et al. 1998). These studies suggest some turtles may either remain in the oceanic habitat in the North Atlantic longer than hypothesized, or they move back and forth between oceanic and coastal habitats interchangeably (Witzell 2002). Stranding records indicate that when immature loggerheads reach 15-24 in (40-60 cm) SCL, they begin to reside in coastal inshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico (Witzell 2002).

After departing the oceanic zone, neritic juvenile loggerheads in the Northwest Atlantic inhabit continental shelf waters from Cape Cod Bay, Massachusetts, south through Florida, The Bahamas, Cuba, and the Gulf of Mexico. Estuarine waters of the United States, including areas such as Long Island Sound, Chesapeake Bay, Pamlico and Core Sounds, Mosquito and Indian River Lagoons, Biscayne Bay, Florida Bay, as well as numerous embayments fringing the Gulf of Mexico, comprise important inshore habitat. Along the Atlantic and Gulf of Mexico shoreline, essentially all shelf waters are inhabited by loggerheads (Conant et al. 2009).

Like juveniles, non-nesting adult loggerheads also use the neritic zone. However, these adult loggerheads do not use the relatively enclosed shallow-water estuarine habitats with limited ocean access as frequently as juveniles. Areas such as Pamlico Sound, North Carolina, and the Indian River Lagoon, Florida, are regularly used by juveniles but not by adult loggerheads. Adult loggerheads do tend to use estuarine areas with more open ocean access, such as the Chesapeake Bay in the U.S. mid-Atlantic. Shallow-water habitats with large expanses of open ocean access,

6 Neritic refers to the nearshore marine environment from the surface to the sea floor where water depths do not exceed 200 meters.

such as Florida Bay, provide year-round resident foraging areas for significant numbers of male and female adult loggerheads (Conant et al. 2009).

Offshore, adults primarily inhabit continental shelf waters, from New York south through Florida, The Bahamas, Cuba, and the Gulf of Mexico. Seasonal use of mid-Atlantic shelf waters, especially offshore New Jersey, Delaware, and Virginia during summer months, and offshore shelf waters, such as Onslow Bay (off the North Carolina coast), during winter months has also been documented (Hawkes et al. 2007)Georgia Department of Natural Resources, unpublished data; South Carolina Department of Natural Resources, unpublished data). Satellite telemetry has identified the shelf waters along the west Florida coast, The Bahamas, Cuba, and the Yucatán Peninsula as important resident areas for adult female loggerheads that nest in Florida (Foley et al. 2008; Girard et al. 2009; Hart et al. 2012). The southern edge of the Grand Bahama Bank is important habitat for loggerheads nesting on the Cay Sal Bank in The Bahamas, but nesting females are also resident in the bights of Eleuthera, Long Island, and Ragged Islands. They also reside in Florida Bay in the United States, and along the north coast of Cuba (A. Bolten and K. Bjorndal, University of Florida, unpublished data). Moncada et al. (2010) report the recapture of 5 adult female loggerheads in Cuban waters originally flipper-tagged in Quintana Roo, Mexico, which indicates that Cuban shelf waters likely also provide foraging habitat for adult females that nest in Mexico.

Status and Population Dynamics

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

Numbers of nests and nesting females can vary widely from year to year. Nesting beach surveys, though, can provide a reliable assessment of trends in the adult female population, due to the strong nest site fidelity of female loggerhead sea turtles, as long as such studies are sufficiently long and survey effort and methods are standardized (e.g., NMFS and USFWS 2008). NMFS and USFWS (2008) concluded that the lack of change in 2 important demographic parameters of loggerheads, remigration interval and clutch frequency, indicate that time series on numbers of nests can provide reliable information on trends in the female population.

<u>Peninsular Florida Recovery Unit</u>

The Peninsular Florida Recovery Unit (PFRU) is the largest loggerhead nesting assemblage in the Northwest Atlantic. A near-complete nest census (all beaches including index nesting beaches) undertaken from 1989 to 2007 showed an average of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (NMFS and USFWS 2008). The statewide estimated total for 2015 was 89,295 nests (FWRI nesting database).

In addition to the total nest count estimates, the Florida Fish and Wildlife Research Institute (FWRI) uses an index nesting beach survey method. The index survey uses standardized data-collection criteria to measure seasonal nesting and allow accurate comparisons between beaches and between years. This provides a better tool for understanding the nesting trends (Figure 8). FWRI performed a detailed analysis of the long-term loggerhead index nesting data (1989-2016;

http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trend/). Over that time period, 3 distinct trends were identified. From 1989-1998, there was a 24% increase that was followed by a sharp decline over the subsequent 9 years. A large increase in loggerhead nesting has occurred since, as indicated by the 71% increase in nesting over the 10-year period from 2007 and 2016. Nesting in 2016 also represents a new record for loggerheads on the core index beaches. FWRI examined the trend from the 1998 nesting high through 2016 and found that the decade-long post-1998 decline was replaced with a slight but nonsignificant increasing trend. Looking at the data from 1989 through 2016, FWRI concluded that there was an overall positive change in the nest counts although it was not statistically significant due to the wide variability between 2012-2016 resulting in widening confidence intervals (http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trend/).

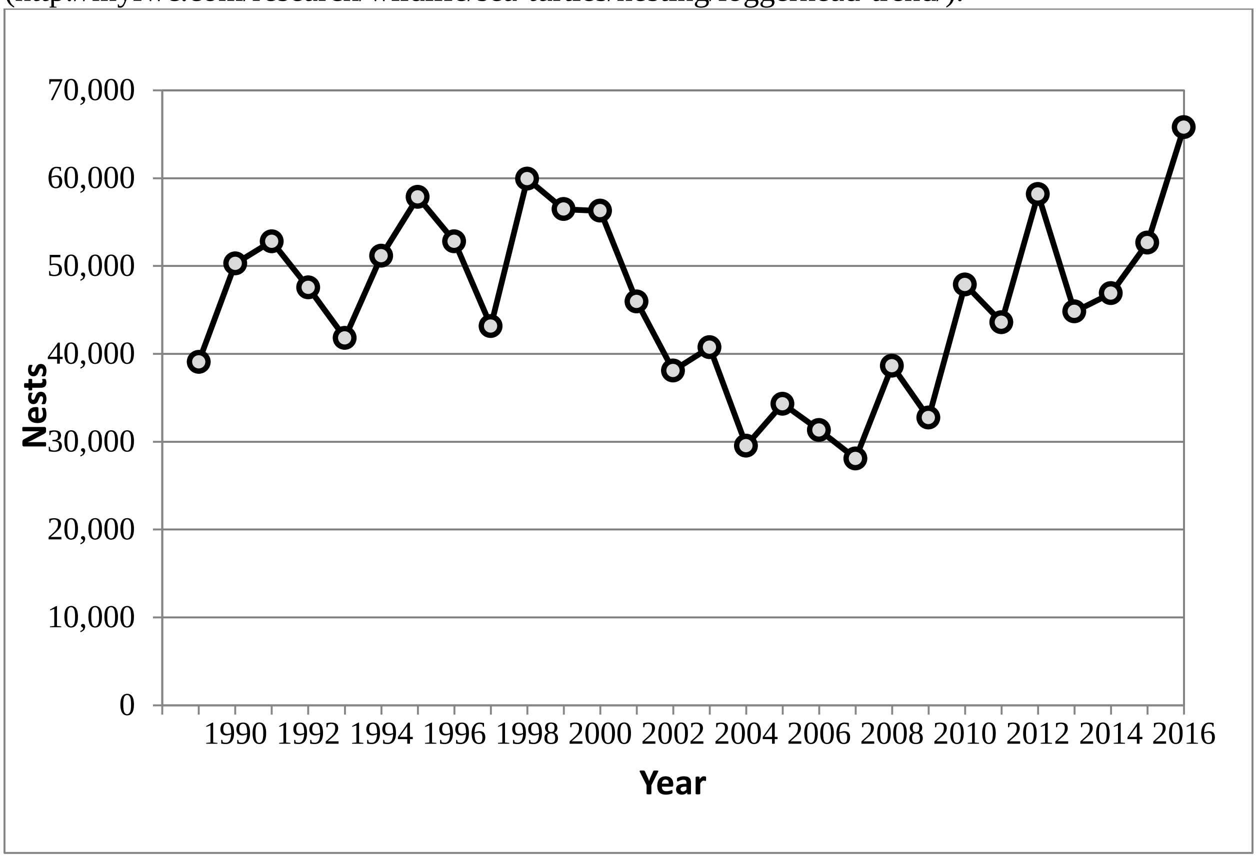

Figure 8. Loggerhead sea turtle nesting at Florida index beaches since 1989

<u>Northern Recovery Unit</u>

Annual nest totals from beaches within the Northern Recovery Unit (NRU) averaged 5,215 nests from 1989-2008, a period of near-complete surveys of NRU nesting beaches (Georgia Department of Natural Resources [GADNR] unpublished data, North Carolina Wildlife Resources Commission [NCWRC] unpublished data, South Carolina Department of Natural Resources [SCDNR] unpublished data), and represent approximately 1,272 nesting females per year, assuming 4.1 nests per female (Murphy and Hopkins 1984). The loggerhead nesting trend from daily beach surveys showed a significant decline of 1.3% annually from 1989-2008. Nest totals from aerial surveys conducted by SCDNR showed a 1.9% annual decline in nesting in South Carolina from 1980-2008. Overall, there are strong statistical data to suggest the NRU had experienced a long-term decline over that period of time.

Data since that analysis (Table 7) are showing improved nesting numbers and a departure from the declining trend. Georgia nesting has rebounded to show the first statistically significant increasing trend since comprehensive nesting surveys began in 1989 (Mark Dodd, GADNR press release, http://www.georgiawildlife.com/node/3139). South Carolina and North Carolina nesting have also begun to shift away from the past declining trend. Loggerhead nesting in Georgia, South Carolina, and North Carolina all broke records in 2015 and then topped those records again in 2016.

Table 7. Total Number of NRU Loggerhead Nests (GADNR, SCDNR, and NCWRC nesting datasets compiled at Seaturtle.org)

Nests Recorded	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Georgia	1,649	998	1,760	1,992	2,241	2,289	1,196	2,319	3,265
South Carolina	4,500	2,182	3,141	4,015	4,615	5,193	2,083	5,104	6,443
North Carolina	841	302	856	950	1,074	1,260	542	1,254	1,612
Total	**6,990**	**3,472**	**5,757**	**6,957**	**7,930**	**8,742**	**3,821**	**8,677**	**11,320**

South Carolina also conducts an index beach nesting survey similar to the one described for Florida. Although the survey only includes a subset of nesting, the standardized effort and locations allow for a better representation of the nesting trend over time. Increases in nesting were seen for the period from 2009-2012, and 2012 shows the highest index nesting total since the start of the program (Figure 9).

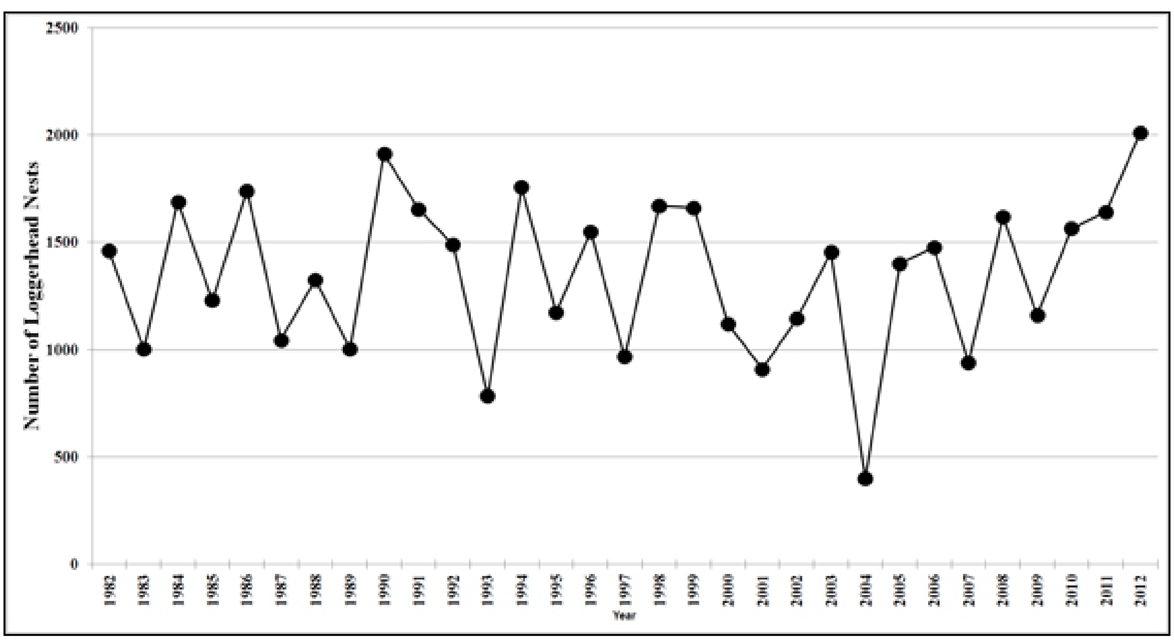

Figure 9. South Carolina index nesting beach counts for loggerhead sea turtles (from the SCDNR website: http://www.dnr.sc.gov/seaturtle/nest.htm)

Other Northwest Atlantic DPS Recovery Units

The remaining 3 recovery units—Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU)—are much smaller nesting assemblages, but they are still considered essential to the continued existence of the species. Nesting surveys for the DTRU are conducted as part of Florida's statewide survey program. Survey effort was relatively stable during the 9-year period from 1995-2004, although the 2002 year was missed. Nest counts ranged from 168-270, with a mean of 246, but there was no detectable trend during this period (NMFS and USFWS 2008). Nest counts for the NGMRU are focused on index beaches rather than all beaches where nesting occurs. Analysis of the 12-year dataset (1997-2008) of index nesting beaches in the area shows a statistically significant declining trend of 4.7% annually. Nesting on the Florida Panhandle index beaches, which represents the majority of NGMRU nesting, had shown a large increase in 2008, but then declined again in 2009 and 2010 before rising back to a level similar to the 2003-2007 average in 2011. Nesting survey effort has been inconsistent among the GCRU nesting beaches, and no trend can be determined for this subpopulation (NMFS and USFWS 2008). Zurita et al. (2003) found a statistically significant increase in the number of nests on 7 of the beaches on Quintana Roo, Mexico, from 1987-2001, where survey effort was consistent during the period. Nonetheless, nesting has declined since 2001, and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008).

In-water Trends

Nesting data are the best current indicator of sea turtle population trends, but in-water data also provide some insight. In-water research suggests the abundance of neritic juvenile loggerheads is steady or increasing. Although Ehrhart et al. (2007) found no significant regression-line trend in a long-term dataset, researchers have observed notable increases in catch per unit effort (CPUE) (Arendt et al. 2009; Ehrhart et al. 2007; Epperly et al. 2007). Researchers believe that this increase in CPUE is likely linked to an increase in juvenile abundance, although it is unclear whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence. Bjorndal et al. (2005), cited in NMFS and USFWS (2008), caution about extrapolating localized in-water trends to the broader population and relating localized trends in neritic sites to population trends at nesting beaches. The apparent overall increase in the abundance of neritic loggerheads in the southeastern United States may be due to increased abundance of the largest oceanic/neritic juveniles (historically referred to as small benthic juveniles), which could indicate a relatively large number of individuals around the same age may mature in the near future (TEWG 2009). In-water studies throughout the eastern United States, however, indicate a substantial decrease in the abundance of the smallest oceanic/neritic juvenile loggerheads, a pattern corroborated by stranding data (TEWG 2009).

Population Estimate

The NMFS Southeast Fisheries Science Center developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS-SEFSC 2009). The model uses the range of published information for the various parameters including mortality by stage, stage duration (years in a stage), and fecundity parameters such as eggs per nest, nests per nesting female, hatchling emergence success, sex ratio, and remigration interval. Resulting trajectories of model runs for each individual recovery unit, and the western North Atlantic population as a whole, were found to be very similar. The model run estimates from the adult female population size for the western North Atlantic (from the 2004-2008 time frame), suggest the adult female population size is approximately 20,000-40,000 individuals, with a low likelihood of females' numbering up to 70,000 (NMFS-SEFSC 2009). A less robust estimate for total benthic females in the western North Atlantic was also obtained, yielding approximately 30,000-300,000 individuals, up to less than 1 million (NMFS-SEFSC 2009). A preliminary regional abundance survey of loggerheads within the northwestern Atlantic continental shelf for positively identified loggerhead in all strata estimated about 588,000 loggerheads (interquartile range of 382,000-817,000). When correcting for unidentified turtles in proportion to the ratio of identified turtles, the estimate increased to about 801,000 loggerheads (interquartile range of 521,000-1,111,000) (NMFS-NEFSC 2011).

Threats (Specific to Loggerhead Sea Turtles)
The threats faced by loggerhead sea turtles are well summarized in the general discussion of threats in Section 4.2.1. Yet the impact of fishery interactions is a point of further emphasis for this species. The joint NMFS and USFWS Loggerhead Biological Review Team determined that the greatest threats to the NWA DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009).

Regarding the impacts of pollution, loggerheads may be particularly affected by organochlorine contaminants; they have the highest organochlorine concentrations (Storelli et al. 2008) and metal loads (D'Ilio et al. 2011) in sampled tissues among the sea turtle species. It is thought that dietary preferences were likely to be the main differentiating factor among sea turtle species. Storelli et al. (2008) analyzed tissues from stranded loggerhead sea turtles and found that mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals, and porpoises (Law et al. 1991).

While oil spill impacts are discussed generally for all species in Section 4.2.1, specific impacts of the DWH oil spill event on loggerhead sea turtles are considered here. Impacts to loggerhead sea turtles occurred to offshore small juveniles as well as large juveniles and adults. A total of 30,800 small juvenile loggerheads (7.3% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. Of those exposed, 10,700 small juveniles are estimated to have died as a result of the exposure. In contrast to small juveniles, loggerheads represented a large proportion of the adults and large juveniles exposed to and killed by the oil. There were 30,000 exposures (almost 52% of all exposures for those age/size classes) and 3,600 estimated mortalities. A total of 265 nests (27,618 eggs) were also translocated during response efforts, with 14,216 hatchlings released, the fate of which is unknown (DWH Trustees 2015). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

Unlike Kemp's ridleys, the majority of nesting for the Northwest Atlantic Ocean loggerhead DPS occurs on the Atlantic coast, and thus loggerheads were impacted to a relatively lesser degree. However, it is likely that impacts to the NGMRU of the NWA loggerhead DPS would be proportionally much greater than the impacts occurring to other recovery units. Impacts to nesting and oiling effects on a large proportion of the NGMRU recovery unit, especially mating and nesting adults likely had an impact on the NGMRU. Based on the response injury evaluations for Florida Panhandle and Alabama nesting beaches (which fall under the NFMRU), the Trustees estimated that approximately 20,000 loggerhead hatchlings were lost due to DWH oil spill response activities on nesting beaches. Although the long-term effects remain unknown, the DWH oil spill event impacts to the Northern Gulf of Mexico Recovery Unit may result in some nesting declines in the future due to a large reduction of oceanic age classes during the DWH oil spill event. Although adverse impacts occurred to loggerheads, the proportion of the population that is expected to have been exposed to and directly impacted by the DWH oil spill event is relatively low. Thus we do not believe a population-level impact occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

Specific information regarding potential climate change impacts on loggerheads is also available. Modeling suggests an increase of 2°C in air temperature would result in a sex ratio of over 80% female offspring for loggerheads nesting near Southport, North Carolina. The same increase in air temperatures at nesting beaches in Cape Canaveral, Florida, would result in close to 100% female offspring. Such highly skewed sex ratios could undermine the reproductive capacity of the species. More ominously, an air temperature increase of 3°C is likely to exceed the thermal threshold of most nests, leading to egg mortality (Hawkes et al. 2007). Warmer sea surface temperatures have also been correlated with an earlier onset of loggerhead nesting in the spring (Hawkes et al. 2007; Weishampel et al. 2004), short inter-nesting intervals (Hays et al. 2002), and shorter nesting seasons (Pike et al. 2006).

4.7 Gulf Sturgeon

Gulf sturgeon (*Acipenser oxyrinchus desotoi)* were listed as threatened effective October 30, 1991 (56 CFR 49653, September 30, 1991), after their stocks were greatly reduced or extirpated throughout much of their historic range by overfishing, dam construction, and habitat degradation. NMFS and the USFWS jointly manage Gulf sturgeon. In riverine habitats, USFWS is responsible for all consultations regarding Gulf sturgeon and critical habitat. In estuarine habitats, responsibility is divided based on the action agency involved. USFWS consults with the Department of Transportation, the Environmental Protection Agency (EPA), the U.S. Coast Guard (USCG), and the Federal Emergency Management Agency; NMFS consults with the Department of Defense, USACE, Bureau of Ocean Energy Management (BOEM), and any other Federal agencies not specifically mentioned at 50 CFR 226.214. In marine areas, NMFS is responsible for all consultations regarding Gulf sturgeon and critical habitat. In 2009, NMFS and USFWS conducted a 5-year review and found Gulf sturgeon continued to meet the definition of a threatened species (USFWS and NMFS 2009).

Species Description and Distribution
The Gulf sturgeon is a subspecies of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Gulf sturgeon are nearly cylindrical fish with an extended snout, vertical mouth, 5 rows of scutes

(bony plates surrounding the body), 4 chin barbels (slender, whisker-like feelers extending from the head used for touch and taste), and a heterocercal (upper lobe is longer than lower) caudal fin (tail fin). Adults range from 6-8 ft in length and weigh up to 200 lb; females grow larger than males. Gulf sturgeon spawn in freshwater and then migrate to feed and grow in estuarine/marine (brackish/salt) waters. Large subadults and adults feed primarily on lancelets, brachiopods, amphipods and other crustaceans, polychaetes, and gastropods. Small Gulf sturgeons feed on benthic infauna such as amphipods, grass shrimp, isopods, oligochaetes, polychaetes, and chironomid and ceratopogonid larvae, found in the intertidal zone. Subadults of more than 5 kg and adults in the freshwater middle river reaches essentially fast during the summer and fall (Mason Jr. and Clugston 1993).

Historically, Gulf sturgeon occurred from the Mississippi River east to Tampa Bay. Sporadic occurrences were recorded as far west as the Rio Grande River in Texas and Mexico, and as far east and south as Florida Bay (Reynolds 1993; Wooley and Crateau 1985). The subspecies' present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi respectively, east to the Suwannee River in Florida.

Life History

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

Gulf sturgeon move from the Gulf of Mexico into coastal rivers in early spring (i.e., March through May). (Fox et al. 2000) found water temperatures at time of river entry differed significantly by reproductive stage and sex. Individuals entered the river system when water temperatures ranged anywhere between 11.2°C and 27.1°C. Spawning occurs in the upper reaches of rivers in the spring when water temperature is around 15^{o}C to 20^{o}C. While Sulak and Clugston (1999) suggested that sturgeon spawning activity is related to moon phase, other researchers have found little evidence of spawning associated with lunar cycles (Fox et al. 2000; Slack et al. 1999). Fertilization is external; females deposit their eggs on the river bottom and males fertilize them. Gulf sturgeon eggs are demersal, adhesive, and vary in color from gray to brown to black (Huff 1975; Vladykov and Greely 1963). Parauka et al. (1991) reported that hatching time for artificially spawned Gulf sturgeon ranged from 85.5 hours at 18.4°C to 54.4 hours at about 23°C. Published research on the life history of younger Gulf sturgeon is limited. After hatching, young-of-year individuals generally disperse downstream of spawning sites, though some may travel upstream as well (Clugston et al. 1995; Sulak and Clugston 1999), and move into estuarine feeding areas for the winter months.

Tagging studies confirm that Gulf sturgeon exhibit a high degree of river fidelity (Carr 1983). Of 4,100 fish tagged, 21% (860 of 4,100 fish) were later recaptured in the river of their initial collection, 8 fish (0.2%) moved between river systems, and the remaining fish (78.8%) have not yet been recaptured (USFWS and GSMFC 1995). There is no information documenting the presence of spawning adults in non-natal rivers. Still, there is some evidence of movements by both male and female Gulf sturgeon (n = 22) from natal rivers into non-natal rivers (Carr et al. 1996; Craft et al. 2001; Fox et al. 2002; Ross et al. 2001a; Wooley and Crateau 1985).

Gene flow is low in Gulf sturgeon stocks, with each stock exchanging less than one mature female per generation (Waldman and Wirgin 1998). Genetic studies confirm that Gulf sturgeon exhibit river-specific fidelity. Stabile et al. (1996) analyzed tissue taken from Gulf sturgeon in 8 drainages along the Gulf of Mexico for genetic diversity and noted significant differences among Gulf sturgeon stocks, which suggests region-specific affinities and likely river-specific fidelity. Five regional or river-specific stocks (from west to east) have been identified: (1) Lake Pontchartrain and Pearl River, (2) Pascagoula River, (3) Escambia and Yellow Rivers, (4) Choctawhatchee River, and (5) Apalachicola, Ochlockonee, and Suwannee Rivers (Stabile et al. 1996).

After spawning, Gulf sturgeon move downstream to areas referred to as summer resting or holding areas. Adults and subadults are not distributed uniformly throughout the river, but show a preference for these discrete holding areas usually located in the lower and middle river reaches (Hightower et al. 2002). While it was suggested these "holding areas" were sought for cooler water temperatures (Carr et al. 1996; Chapman and Carr 1995; Hightower et al. 2002) found that water temperatures in holding areas where Gulf sturgeon were repeatedly found in the Choctawhatchee River were similar to temperatures where sturgeon were only occasionally found elsewhere in the river.

In the fall, movement from the rivers into the estuaries and associated bays begins in September (at water temperatures around 23°C) and continues through November (Foster and Clugston 1997; Huff 1975; Wooley and Crateau 1985). Because the adult and large subadult sturgeon have spent at least 6 months fasting or foraging sparingly on detritus (Mason Jr. and Clugston 1993) in the rivers, it is presumed they immediately begin foraging. Telemetry data indicate Gulf sturgeon are found in high concentrations near the mouths of their natal rivers with individual fish traveling relatively quickly between foraging areas where they spend an extended period of time (Edwards et al. 2007; Edwards et al. 2003).

Most subadult and adult Gulf sturgeon spend the cool winter months (October/November through March/April) in the bays, estuaries, and the nearshore Gulf of Mexico (Clugston et al. 1995; Fox et al. 2002; Odenkirk 1989). Tagged fish have been located in well-oxygenated shallow water (less than 7 m) areas that support burrowing macro invertebrates (Craft et al. 2001; Fox and Hightower 1998; Fox et al. 2002; Parauka et al. 2001; Rogillio et al. 2007; Ross et al. 2001a; Ross et al. 2009). These areas may include shallow shoals 5-7 ft (1.5-2.1 m), deep holes near passes (Craft et al. 2001), unvegetated sand habitats such as sandbars, and intertidal and subtidal energy zones (Abele and Kim 1986; Menzel 1971; Ross et al. 2009). Subadult and adult Gulf sturgeon overwintering in Choctawhatchee Bay (Florida) were generally found to occupy the sandy shoreline habitat at depths of 4-6 ft (2-3 m) (Fox et al. 2002; Parauka et al. 2001). These shifting, predominantly sandy, areas support a variety of potential prey items including estuarine crustaceans, small bivalve mollusks, ghost shrimp, small crabs, various polychaete worms, and lancelets (Abele and Kim 1986; Menzel 1971; Williams et al. 1989), (M. Brim, USFWS, pers. comm. to S. Bolden, NMFS, December 2, 2002). Preference for sandy habitat is supported by studies in other areas that have correlated Gulf sturgeon presence to sandy substrate (Fox et al. 2002).

Gulf sturgeon are described as opportunistic and indiscriminate benthivores that change their diets and foraging areas during different life stages. Their guts generally contain benthic marine invertebrates including amphipods, lancelets, polychaetes, gastropods, shrimp, isopods, molluscs, and crustaceans (Carr et al. 1996; Fox et al. 2002; Huff 1975; Mason Jr. and Clugston 1993). Generally, Gulf sturgeon prey are burrowing species that feed on detritus and/or suspended particles, and inhabit sandy substrate. In the river, young-of-the-year sturgeon eat aquatic invertebrates and detritus (Mason Jr. and Clugston 1993; Sulak and Clugston 1999) and juveniles forage throughout the river on aquatic insects (e.g., mayflies and caddis flies), worms (oligochaete), and bivalves (Huff 1975; Mason Jr. and Clugston 1993). Adults forage sparingly in freshwater and depend almost entirely on estuarine and marine prey for their growth (Gu et al. 2001). Both adult and subadult Gulf sturgeon are known to lose up to 30% of their total body weight while in fresh water, and subsequently compensate the loss during winter feeding in marine areas (Carr 1983; Clugston et al. 1995; Heise et al. 1999; Morrow et al. 1998; Ross et al. 2000; Sulak and Clugston 1999; Wooley and Crateau 1985).

Status and Population Dynamics

Abundance of Gulf sturgeon is measured at the riverine scale. Currently, 7 rivers are known to support reproducing populations of Gulf sturgeon: Pearl, Pascagoula, Escambia, Yellow, Choctawhatchee, Apalachicola, and Suwannee. Gulf sturgeon abundance estimates by river and year for the 7 known reproducing populations are presented in Table 8. The number of individuals within each riverine population is variable across their range, but generally over the last decade (USFWS and NMFS 2009) populations in the eastern part of the range (Suwannee, Apalachicola Choctawhatchee) appear to be relatively stable in number or have a slightly increasing population trend. In the western portion of the range, populations in the Pearl and Pascagoula Rivers have never been nearly as abundant as those to the east, and their current status, post-hurricanes Katrina and Rita, is unknown as comprehensive surveys have not occurred.

Table 8. Gulf Sturgeon Abundance Estimates by River and Year (with Confidence Intervals [CI] for the 7 Known Reproducing Populations. Data from USFWS and NMFS 2009)

River	Year of data collection	Abundance Estimate	Lower Bound 95% CI	Upper Bound 95% CI	Source
Suwannee	2007	14,000	not reported	not reported	Sulak 2008
Apalachicola	1991	144	83	205	Zehfuss et al. 1999
Choctawhatchee	2008	3314	not reported	not reported	USFWS 2009
Yellow	2003 fall	911	550	1,550	Berg et al. 2007
Escambia	2006	451	338	656	USFWS 2007
Pascagoula	2000	216	124	429	Ross et al. 2001
Pearl	2001	430	323	605	Rogillio et al. 2001

Both acute and episodic events are known to impact individual populations of Gulf sturgeon that in turn affect overall population numbers. For example, on August 9, 2011, an overflow of "black liquor" (an extremely alkaline waste byproduct of the paper industry) was accidentally released by a paper mill into the Pearl River near Bogalusa, Louisiana, that may have affected the status and abundance of the Pearl River population. While paper mills regularly use acid to balance the black liquor's pH before releasing the material, as permitted by the Louisiana Department of Environmental Quality, this material released was not treated.[7] The untreated waste byproduct created a low oxygen ("hypoxic") environment lethal to aquatic life. These hypoxic conditions moved downstream of the release site killing fish and mussels in the Pearl River over several days. Within a week after the spill, the dissolved oxygen concentrations returned to normal in all areas of the Pearl River tested by Louisiana Department of Wildlife and Fisheries (LDWF). The investigation of fish mortality began on August 13, 2011, several days after the spill occurred. Twenty-eight Gulf sturgeon carcasses (38-168 cm TL) were collected in the Pearl River after the spill (Sanzenbach 2011a; Sanzenbach 2011b) and anecdotal information suggests many other Gulf sturgeon carcasses were not collected. The smaller fish collected represent young-of-the-year and indicate spawning is likely occurring in the Pearl River. The spill occurred during the time when Gulf sturgeon were still occupying the freshwater habitat. Because the materials moved downriver after the spill, the entire Pearl River population of Gulf sturgeon was likely impacted.

Threats

The 1991 Listing Rule for Gulf sturgeon cited the following impacts and threats: (1) Dams on the Pearl, Alabama, and Apalachicola rivers; also on the North Bay arm of St. Andrews Bay; (2) channel improvement and maintenance activities: dredging and de-snagging; (3) water quality degradation; and (4) contaminants.

In 2009, NMFS and USFWS conducted a 5-year review of the Gulf sturgeon and identified several new threats to the Gulf sturgeon (USFWS and NMFS 2009). The following is a comprehensive list of threats to Gulf sturgeon, additional details can be found in the 5-year status review (USFWS and NMFS 2009):

Pollution from industrial, agricultural, and municipal activities is believed responsible for a suite of physical, behavioral, and physiological impacts to sturgeon worldwide. Specific impacts of pollution and contamination on sturgeon have been identified to include muscle atrophy, abnormality of gonad, sperm, and egg development, morphogenesis of organs, tumors, and disruption of hormone production.

Chemicals and metals such as chlordane, dichlorodiphenyldichloroethylene (DDE), DDT, dieldrin, polychlorinated biphenyls, cadmium, mercury, and selenium settle to the river bottom and are later incorporated into the food web as they are consumed by benthic feeders, such as sturgeon or macroinvertebrates.

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[7] The extreme alkalinity of the untreated black liquor caused it to quickly bond with oxygen (aerobic) to dissociate in water. This reduced the amount of oxygen available within the water column, creating a hypoxic environment (< 1mg/L of dissolved oxygen) lethal to aquatic life.

Bycatch from fisheries may continue although all directed fisheries of Gulf sturgeon have been closed since 1990 (USFWS and GSMFC 1995). Although confirmed reports are rare, it is a common opinion among Gulf sturgeon researchers that bycatch mortality continues.

Dredging activities can pose significant impacts to aquatic ecosystems by: (1) direct removal/burial of organisms; (2) turbidity/siltation effects; (3) contaminant re-suspension; (4) noise/disturbance; (5) alterations to hydrodynamic regime and physical habitat; and (6) loss of riparian habitat. Dredging operations may also destroy benthic feeding areas, disrupt spawning migrations, and re-suspend fine sediments causing siltation over required substrate in spawning habitat. Because Gulf sturgeon are benthic omnivores, the modification of the benthos affects the quality, quantity, and availability of prey.

Collisions between jumping Gulf sturgeon and fast-moving boats on the Suwannee River and elsewhere are a relatively recent and new source of sturgeon mortality and pose a serious public safety issue as well. The Florida Fish and Wildlife Commission documented 3 collisions in the Suwannee River in 2008, and 1 incident in 2009.

Dams represent a significant impact to Gulf sturgeon by blocking passage to historical spawning habitats, which reduces the amount of available spawning habitat or entirely impede access to it. The ongoing operations of these dams also affect downstream habitat.

Global climate change may affect Gulf sturgeon by leading to accelerated changes in habitats utilized by Gulf sturgeon through saltwater intrusion, changes in water temperature, and extreme weather periods that could increase both droughts and floods.

Hurricanes have resulted in mortality of Gulf sturgeon in both Escambia Bay after Hurricane Ivan in 2004 (USFWS 2005) and Hurricane Katrina in 2005.

Red tide is the common name for a harmful algal bloom (HAB) of marine algae (*Karenia brevis*) that produces a brevetoxin that is absorbed directly across the gill membranes of fish or through ingestion of algal cells. Fish mortalities associated with *K. brevis* events are very common and widespread. Blooms of red tides have been in increasing in frequency in the Gulf of Mexico since the 1990s and have likely killed Gulf sturgeon at both the juvenile and adult life stages.

Aquaculture in the State of Florida has Best Management Practices to reduce the risk of hybridization and escapement, however, the threat of introduction of captive fishes into the wild continues.

Summary of the Status of Gulf Sturgeon

In summary, the Gulf sturgeon population is estimated to number approximately 19,000 individuals. The number of individuals within each riverine population is variable across their range, but generally over the last decade (USFWS and NMFS 2009) populations in the eastern part of the range (Suwannee, Apalachicola, Choctawhatchee) appear to be relatively stable in number or have a slightly increasing population trend. Recovery of depleted populations is an inherently slow process for a late-maturing species such as Gulf sturgeon. Their late age at maturity provides more opportunities for individuals to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, this is hampered within the species range by habitat alteration, pollution, and bycatch.

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

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

4.8 Gulf Sturgeon Critical Habitat

NMFS and USFWS jointly designated GSCH on April 18, 2003 (*see,* 50 CFR 226.214). The agencies designated 7 riverine areas (Units 1-7) and 7 estuarine/marine areas (Units 8-14) as critical habitat based on the physical and biological features that support the species. Critical habitat units encompass a total of 2,783 river kilometers (rkm) and 6,042 km^2 of estuarine and marine habitats (Figure 10). NMFS's jurisdiction encompasses the 7 units in marine and estuarine waters (Units 8-14).

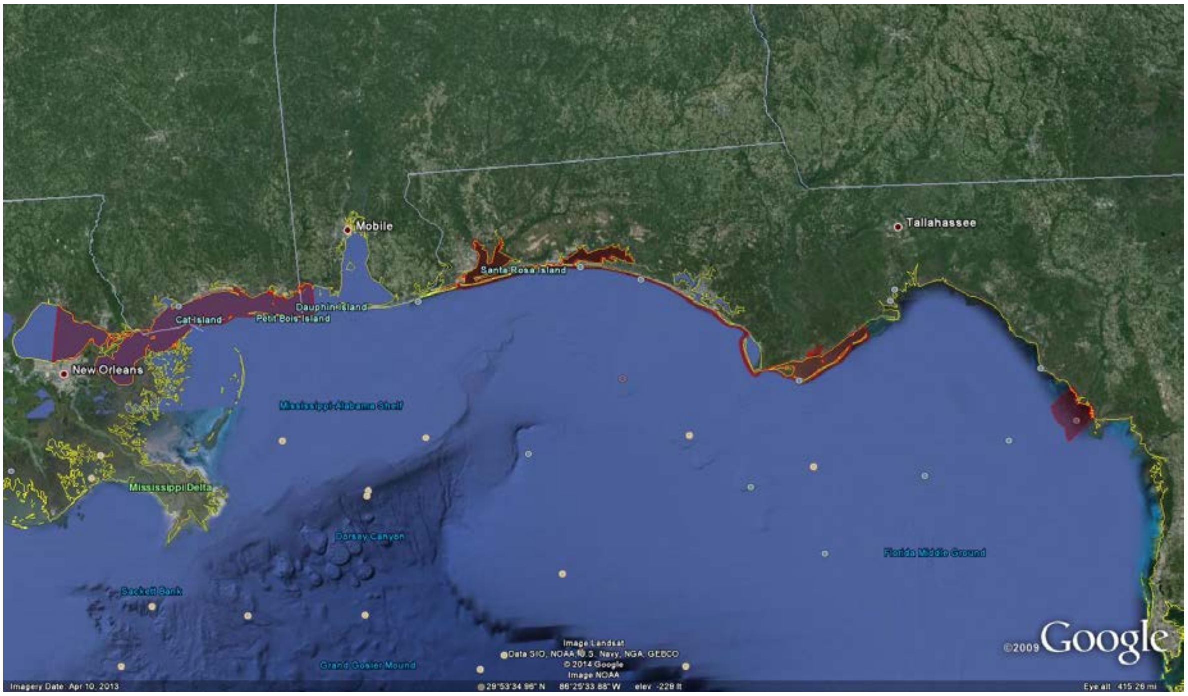

Figure 10. Gulf Sturgeon Critical Habitat in Estuarine and Marine Waters (Units 8-14) (©2015 Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO)

Gulf sturgeon use rivers for spawning, larval and juvenile feeding, adult resting and staging, and to move between the areas that support these components. Gulf sturgeon use the lower riverine, estuarine, and marine environment during winter months primarily for feeding and for inter-river migrations. Within the estuarine environment, Gulf sturgeon are typically found in waters 2-4 m deep and use depths outside this range less than expected based on availability (Fox et al. 2002). Further, the 2- to 4-m deep habitats where Gulf sturgeon are typically found have sediments with a high percentage (> 80%) of sand (Fox et al. 2002). Adult sturgeon appear to spend extended periods of time in specific areas of the estuary and then travel relatively quickly to other areas where they again spend extended amounts of time (Edwards et al. 2007; Edwards et al. 2003). Sulak et al. (2012) believe Gulf sturgeon feed continuously during these periods which may last for 1-3 months. Additionally, it appears that there may be certain areas where Gulf sturgeon concentrate. USFWS discovered nearshore areas of concentrated feeding activity for adults from multiple riverine systems in the waters near Tyndall Air Force Base/Panama City Beach, Florida, and waters from Perdido, Florida to Gulf Shores, Alabama (USFWS 2004; USFWS 2005; USFWS 2006; USFWS 2007). Estuaries and bays adjacent to riverine areas provide unobstructed passage of sturgeon from feeding areas to spawning grounds.

Critical Habitat Unit Impacted by this Action

This project is located in Unit 8 of GSCH. Unit 8 encompasses Lake Pontchartrain east of the Lake Pontchartrain Causeway, all of Little Lake, The Rigolets, Lake St. Catherine, Lake Borgne, including Heron Bay, and the Mississippi Sound (Figure 11). Critical habitat follows the shorelines around the perimeters of each included lake. The Mississippi Sound includes adjacent open bays including Pascagoula Bay, Point aux Chenes Bay, Grand Bay, Sandy Bay, and barrier island passes, including Ship Island Pass, Dog Keys Pass, Horn Island Pass, and Petit Bois Pass.

The northern boundary of the Mississippi Sound is the shoreline of the mainland between Heron Bay Point, Mississippi and Point aux Pins, Alabama. Critical habitat excludes St. Louis Bay, north of the railroad bridge across its mouth; Biloxi Bay, north of the U.S. Highway 90 bridge; and Back Bay of Biloxi. The southern boundary follows along the broken shoreline of Lake Borgne created by low swamp islands from Malheureux Point to Isle au Pitre. From the northeast point of Isleau Pitre, the boundary continues in a straight north-northeast line to the point 1 nautical mile (nmi) (1.9 km) seaward of the western most extremity of Cat Island (30°13'N, 89°10'W). The southern boundary continues 1 nmi (1.9 km) offshore of the barrier islands and offshore of the 72 COLREGS lines at barrier island passes (defined at 33 CFR80.815)), (d) and (e)) to the eastern boundary. Between Cat Island and Ship Island there is no 72 COLREGS line. We, therefore, defined that section of the unit's southern boundary as 1 nmi (1.9 km) offshore of a straight line drawn from the southern tip of Cat Island to the western tip of Ship Island. The eastern boundary is the line of longitude 88°18.8'W from its intersection with the shore (Point aux Pins) to its intersection with the southern boundary. The lateral extent of Unit 8 is the MHW line on each shoreline of the included water bodies or the entrance to rivers, bayous, and creeks.

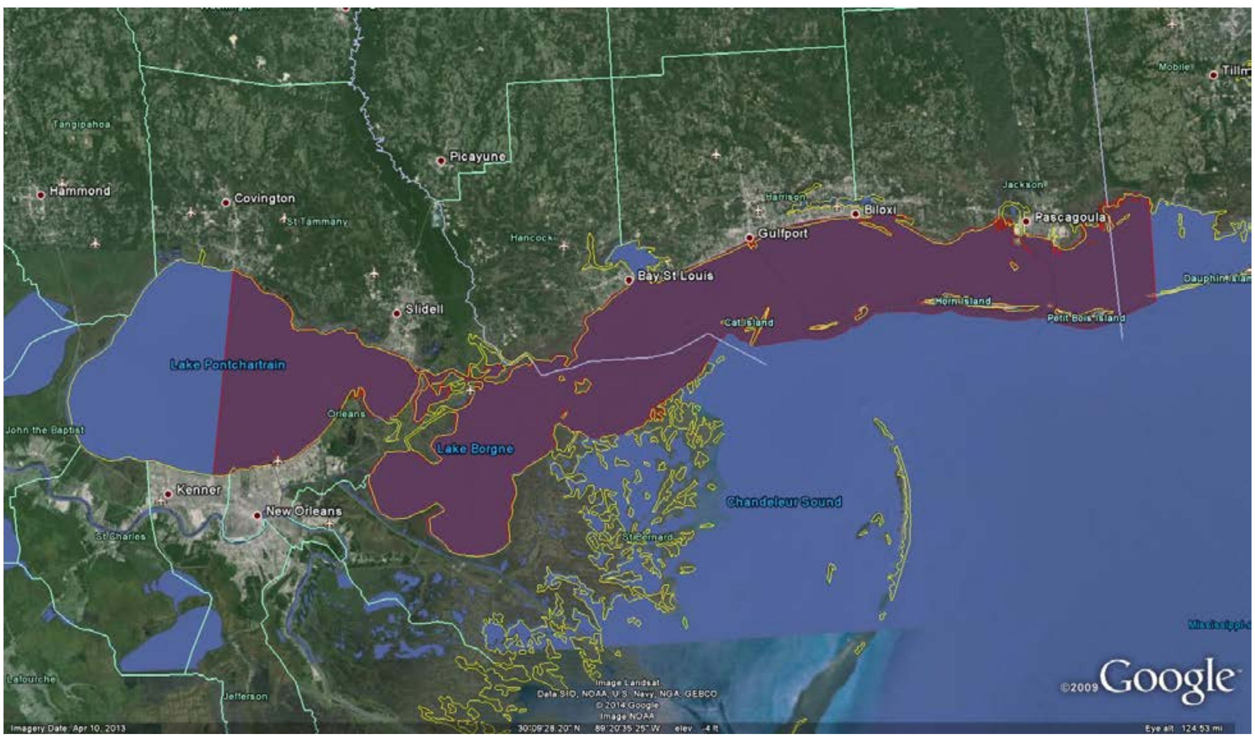

Figure 11. Gulf sturgeon critical habitat Unit 8 (©2015 Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO)

The Pearl River and its distributaries flow into The Rigolets, Little Lake, and Lake Borgne, the western extension of Mississippi Sound. The Rigolets connect Lake Pontchartrain and Lake St. Catherine with Little Lake and Lake Borgne. The Pascagoula River and its distributaries flow into Pascagoula Bay and Mississippi Sound. This unit provides juvenile, subadult, and adult feeding, resting, and passage habitat for Gulf sturgeon from the Pascagoula and the Pearl River subpopulations. One or both of these subpopulations have been documented by tagging data, historic sightings, and incidental captures as using Pascagoula Bay, The Rigolets, the eastern half of Lake Pontchartrain, Little Lake, Lake St. Catherine, Lake Borgne, Mississippi Sound, within 1 nmi (1.9 km) of the nearshore Gulf of Mexico adjacent to the barrier islands and within the passes (Davis et al. 1970; Morrow et al. 1998; Reynolds 1993; Rogillio 1993; Rogillio et al. 2001; Rogillio et al. 2007; Ross et al. 2001a; Ross et al. 2009) (F. Parauka, USFWS, pers. comm. to S. Bolden, NMFS, December 2, 2002). Substrate in these areas ranges from sand to silt, all of which contains known Gulf sturgeon prey items. The Rigolets is an 11.3 km (7 mi)-long and about 0.6 km (0.4 mi)-wide passage connecting Lake Pontchartrain and Lake Borgne. This brackish water area is used by adult Gulf sturgeon as a staging area for osmoregulation and for passage to and from wintering areas (Rogillio et al. 2001). Lake St. Catherine is a relatively shallow lake with depths averaging approximately 1.2 m (4 ft), connected to The Rigolets by Sawmill Pass. Bottom sediments in Sawmill Pass are primarily silt; Lake St. Catherine's are composed of silt and sand (Barrett 1971). Incidental catches of Gulf sturgeon are documented from Lake St. Catherine and Sawmill Pass (Reynolds 1993) (H. Rogillio, Louisiana Department of Wildlife and Fisheries, pers. comm. to S. Bolden, NMFS, December 2, 2002). Based on the proximity of Little Lake, Lake St. Catherine, and Sawmill Pass to The Rigolets and Pearl River, we believe these areas are also used for staging and feeding and, therefore, were included with The Rigolets as critical habitat.

Rogillio (1993) and (Morrow Jr. et al. 1996) indicated that Lake Pontchartrain and Lake Borgne were used by Gulf sturgeon as wintering habitat, with most catches during late September through March. Lake Pontchartrain is 57.9 km (36 mi) long, 35.4 km (22 mi) wide at its widest point, and 3-4.9 m (10-16 ft) deep (USDOC 2002). Morrow Jr. et al. (1996) documented Gulf sturgeon from the Pearl River system using Lake Pontchartrain (verified by tags) and summarized existing Gulf sturgeon records, which indicated greater use of the eastern half of Lake Pontchartrain. Although (Rogillio et al. 2001) did not relocate any of their sonic tagged adult Gulf sturgeon in Lake Pontchartrain, the eastern part of this lake is believed to be an important winter habitat for juveniles and subadults (H. Rogillio, Louisiana Department of Wildlife and Fisheries, pers. comm. to S. Bolden, NMFS, December 2, 2002). Furthermore, we believe that Gulf sturgeon forage in Lake Pontchartrain during the winter. The Lake Pontchartrain Causeway, twin toll highway bridges, extends 33.6 km (20.9 mi) across Lake Pontchartrain from Indian Beach on the south shore to Lewisburg and Mandeville on the north shore. Sediment data from Lake Pontchartrain indicate sediments have a greater sand content east of the causeway than west (Barrett 1971). Most records of Gulf sturgeon from Lake Pontchartrain are located east of the causeway, with concentrations near Bayou Lacombe and Goose Point, both on the eastern north shore (Morrow Jr. et al. 1996; Reynolds 1993). While Gulf sturgeon have also been documented west of the causeway, generally near the mouths of small river systems (Davis et al. 1970), we excluded the western portion of Lake Pontchartrain because we believe that the sturgeon utilizing this area are coming from western tributaries and not the Pearl River. Lake Pontchartrain connects by The Rigolets with Lake Borgne. Lake Borgne, the western extension of Mississippi Sound, is partly separated from Mississippi Sound by Grassy Island, Half Moon (Grand) Island, and Le Petit Pass Island. Lake Borgne is approximately 14.3 km (23 mi) in length, 3-6 km (5-10 mi) in width and 1.8-3 m (6-10 ft) in depth. Many Gulf sturgeon were anecdotally reported as taken incidentally in shrimp trawls in Lake Borgne 0.6-1.2 km (1-2 mi) south of the Pearl River between August and October from the 1950s through the 1980s (Reynolds 1993). There are 22 additional records of Gulf sturgeon in Lake Borgne (D. Walther, USFWS, pers. comm. to S. Bolden, NMFS, December 2, 2002).

Known locations are spread out around the perimeter of the Lake, including at the mouth of The Rigolets, Violet Canal, Bayou Bienvenue, Polebe, Alligator Point, and at Half Moon Island (Reynolds 1993).

The Mississippi Sound is separated from the Gulf of Mexico by a chain of barrier islands, including Cat, Ship, Horn, and Petit Bois Islands. Natural depths of 3.7-5.5 m (12-18 ft) are found throughout the Sound and a channel 3.7 m (12 ft) deep has been dredged where necessary from Mobile Bay to New Orleans. Incidental captures and studies confirm that both Pearl River and Pascagoula River adult Gulf sturgeon winter in the Mississippi Sound, particularly around barrier islands and barrier islands passes (Reynolds 1993; Rogillio et al. 2001; Ross et al. 2001a). Pascagoula Bay is adjacent to the Mississippi Sound. Gulf sturgeon exiting the Pascagoula River move both east and west, with telemetry locations as far east as Dauphin Island and as far west as Cat Island and the entrance to Lake Pontchartrain (Ross et al. 2001a). Tagged Gulf sturgeon from the Pearl River subpopulation have been located between Cat Island, Ship Island, Horn Island, and east of Petit Bois Islands to the Alabama State line (Rogillio et al. 2001). Gulf sturgeon have also been documented within 1 nmi (1.9 km) off the barrier islands of Mississippi Sound. We, therefore, included 1 nmi (1.9 km) offshore of the barrier islands of Mississippi Sound.

Habitat used by Gulf sturgeon in the vicinity of the barrier islands is 1.9-5.9 m (6.2-19.4 ft) deep (average 4.2 m [13.8 ft]), with clean sand substrata (Heise et al. 1999; Rogillio et al. 2001; Ross et al. 2001a). Preliminary data from substrate samples taken in the barrier island areas indicate that all samples contained lancelets (Ross et al. 2001a). Inshore locations where Gulf sturgeon were located (Deer Island, Round Island) were 1.9-2.8 m (6.2-9.2 ft) deep and all had mud (mostly silt and clay) substrata (Heise et al. 1999), typical of substrates supporting known Gulf sturgeon prey.

Physical and Biological Features of Critical Habitat

NMFS and USFWS identified 7 physical and biological habitat features essential for the conservation of Gulf sturgeon. Four of these features are found in the marine and estuarine units of critical habitat:

5. Abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusks and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages
6. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages
7. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages
8. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., an unobstructed river or a dammed river that still allows for passage)

Status of Critical Habitat Unit 8

Activities associated with coastal development have been and continue to be the primary threat to marine and estuarine units of GSCH. These activities generally include dredge and fill projects, freshwater withdrawals, and storm water drainage systems. Although many coastal development activities are currently regulated, some permitted direct and/or indirect damage to habitat from increased urbanization still occurs and is expected to continue in the future.

Unit 8 is impacted by a number of activities including dredging, shoreline armoring, installation of breakwaters, and construction of docks, piers, marinas, and artificial reefs. Since tracking began in 2003, Unit 8 has had 66,546 acres of critical habitat impacted. Most of these impacts were temporary, with effects lasting a few days to months, but generally less than a year. There has been a permanent loss of 655 acres of critical habitat during that time period, but much of this area lacked the Physical or Biological Features (PBFs).

In 2014, NMFS consulted on 15 projects in Unit 8: 8 pier/dock projects, 3 dredging projects, 2 restoration projects, 1 jetty, and 1 beach nourishment project. In 2015, NMFS consulted on 8 projects in Unit 8: 2 dredging projects, 2 marsh restoration projects, 1 beach nourishment project, 1 geotechnical exploration project, 1 pier/dock project, 1 navigational aid project. These projects are not expected to adversely affect the essential features of Unit 8, and any impacts from these projects should only be temporary or discountable. No projects were consulted on in 2016.

Threats to Critical Habitat

As stated in the Final Rule designating GSCH, the following activities, when authorized, funded or carried out by a federal agency, may destroy or adversely modify critical habitat in marine or estuarine environments:

- Actions that would appreciably reduce the abundance of estuarine and marine prey for juvenile and adult Gulf sturgeon, within a designated critical habitat unit, such as dredging, dredged material disposal, channelization, in-stream mining, and land uses that cause excessive turbidity or sedimentation
- Actions that would alter water quality within a designated critical habitat unit, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, such that it is appreciably impaired for normal Gulf sturgeon behavior, reproduction, growth, or viability, such as dredging; dredged material disposal; channelization; impoundment; in-stream mining; water diversion; dam operations; land uses that cause excessive turbidity; and release of chemicals, biological pollutants, or heated effluents into surface water or connected groundwater via point sources or dispersed non-point sources
- Actions that would alter sediment quality within a designated critical habitat unit such that it is appreciably impaired for normal Gulf sturgeon behavior, reproduction, growth, or viability, such as dredged material disposal; channelization; impoundment; in-stream mining; land uses that cause excessive sedimentation; and release of chemical or biological pollutants that accumulate in sediments
- Actions that would obstruct migratory pathways within and between adjacent riverine, estuarine, and marine critical habitat units, such as dams, dredging, point-source-pollutant discharges, and other physical or chemical alterations of channels and passes that restrict Gulf sturgeon movement (68 FR 13399)

Dredge and fill activities associated with the creation and maintenance of navigation channels as well as coastal development can result in the loss of Gulf sturgeon habitat (Wooley and Crateau 1985). Dredging activities can pose significant impacts to aquatic ecosystems by (1) direct removal/burial of organisms, (2) turbidity/siltation effects, (3) contaminant resuspension, (4) noise/disturbance, (5) alterations to hydrodynamic regime and physical habitat, and (6) loss of the habitats and communities along the river margins and banks (Chytalo 1996; Winger et al. 2000). In regards to Gulf sturgeon and their critical habitat, dredging may alter benthic feeding areas, disrupt spawning migrations, modify substrate composition, and transform benthic morphology. Dredge and fill activities have and continue to threaten GSCH.

Evaluations of water and sediment quality in Gulf Sturgeon habitat on the northern Gulf of Mexico coast have consistently shown elevated pollutant loads. Chemicals and metals such as chlordane, DDE, DDT, dieldrin, PCBs, cadmium, mercury, and selenium settle to the river bottom and are later incorporated into the food web as they are consumed by benthic feeders, such as sturgeon or macroinvertebrates. Some of these compounds may affect physiological processes and impede the ability of a fish to withstand stress, while simultaneously increasing the stress of the surrounding environment by reducing DO, altering pH, and altering other water quality properties. Although little is known about contaminant effects on Gulf sturgeon, pollution from industrial, agricultural, and municipal activities is believed to be responsible for a suite of physical, behavioral, and physiological impacts to sturgeon species worldwide (Agusa et al. 2004; Barannikova 1995; Barannikova et al. 1995; Bickham et al. 1998; Billard and Lecointre 2000; Kajiwara 2003; Khodorevskaya et al. 1997; Khodorevskaya and Krasikov 1999).

5 ENVIRONMENTAL BASELINE

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

This section contains a description of the effects of past and ongoing human factors leading to the current status of the species, their habitat, and ecosystem, within the action area. The environmental baseline is a snapshot of the factors affecting the species and includes state, tribal, local, and private actions already affecting the species, or that will occur at the same time as the consultation in progress. Unrelated future federal actions affecting the same species that have completed consultation are also part of the environmental baseline, as are implemented and ongoing federal and other actions within the action area that may benefit listed species and critical habitat. The purpose of describing the environmental baseline in this manner is to provide context for the effects of the proposed action on the listed species and designated critical habitat.

5.1 Status of Species in the Action Area

Sea turtles
The 4 species of sea turtles that are expected to occur in the action area are all highly migratory. Therefore, the status of the 4 species (or DPS where applicable) of sea turtles in the action area, as well as the threats to these species, are best reflected in their range-wide statuses and supported by the species accounts in Section 4.2-4.6 (Status of Species).

Gulf sturgeon
Gulf sturgeon are known to inhabit and forage in Gulf of Mexico nearshore estuarine and marine habitats during the winter months. Incidental catch of Gulf sturgeon in both federally and state-regulated fisheries has been documented. There have been incidental captures of Gulf sturgeon in the shrimp and gillnet fisheries in Apalachicola Bay (Swift et al. 1977; Wooley and Crateau 1985). Similar incidental catches have been reported in Mobile Bay, Tampa Bay, and Charlotte Harbor. Louisiana Department of Wildlife and Fisheries (LDWF) reported 177 Gulf sturgeon were incidentally captured by commercial fishers in southeast Louisiana during 1992.

Incidental entrainment or capture of Gulf sturgeon in federally regulated navigation and beach renourishment projects has been documented in the Gulf of Mexico. Capture of Gulf sturgeon during required relocation trawling activities associated with hopper dredging near Orange Beach, Alabama captured (nonlethally) 31 Gulf sturgeon over a 3-month period in 2012-2013. In 2004-2005, there were 3 confirmed reports of Gulf sturgeon entrainment (lethal) from hopper dredging. Nearshore telemetry receivers indicate winter habitat for Gulf sturgeon as mostly alongshore the northern coast of Mississippi Sound extending out to the Gulf Islands (USACE 2012). Edwards et al. (2007) reported on data collected from pop-up archival transmitting tags and found all relocations were consistent with alongshore migration and utilization of relatively shallow habitats. The status of Gulf sturgeon in the action area, as well as the threats to this species, is supported by the species account in Section 4.7 (Status of the Species).

5.2 Factors Affecting Sea Turtles in the Action Area

5.2.1 Federal Actions

NMFS has undertaken a number of Section 7 consultations to address the effects of federally permitted dredging and other federal actions on threatened and endangered sea turtle species, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to minimize the adverse effects of the action on sea turtles. The summary below of federal actions and the effects these actions have had on sea turtles includes only those federal actions in the action areas which have already concluded or are currently undergoing formal Section 7 consultation.

5.2.1.1 Federal Dredging Activity

Marine dredging vessels are common within U.S. coastal waters. Although the underwater noises from dredge vessels are typically continuous in duration (for periods of days or weeks at a time) and strongest at low frequencies, they are not believed to have any long-term effect on sea turtles. Still, the construction and maintenance of federal navigation channels and dredging in sand mining sites (borrow areas) have been identified as sources of sea turtle mortality. Hopper dredges in the dredging mode are capable of moving relatively quickly compared to sea turtle swimming speed and can thus overtake, entrain, and kill sea turtles as the suction draghead(s) of the advancing dredge overtakes the resting or swimming turtle. Entrained sea turtles rarely survive.

To reduce take of listed species, relocation trawling may be utilized to capture and move sea turtles. In relocation trawling, a boat equipped with nets precedes the dredge to capture sea turtles and then releases the animals out of the dredge pathway, thus avoiding lethal take. Relocation trawling has been successful and routinely moves sea turtles in the Gulf of Mexico. Recently between April 2016 and June 2016, relocation trawling captured and successfully moved 212 sea turtles near Navarre Beach, Florida with no mortalities (Coastwise Consulting 2016; Trump 2016). In 2003, NMFS completed a Regional Opinion on the impacts of USACE's hopper-dredging operations in the Gulf of Mexico. Subsequent revisions were provided in 2005 and 2007 (NMFS 2003a; NMFS 2005c; NMFS 2007d). In the Gulf of Mexico Regional Opinion (GRBO), NMFS determined that (1) Gulf of Mexico hopper dredging would adversely affect Gulf sturgeon and 4 sea turtle species (i.e., green, hawksbill, Kemp's ridley, and loggerheads), but would not jeopardize their continued existence, and (2) dredging in the Gulf of Mexico would not adversely affect leatherback sea turtles, smalltooth sawfish, or ESA-listed large whales. An ITS for those species adversely affected was issued.

The above-listed Regional Opinion considers maintenance dredging, beach renourishment, and sand mining operations. Numerous other Opinions have been produced that analyzed hopper dredging projects that did not fall (partially or entirely) under the scope of actions contemplated by these Regional Opinions. For example, dredging of Ship Shoal in the Gulf of Mexico Central Planning Area for coastal restoration projects (Opinion issued to MMS, now BOEM, in 2005 (NMFS 2005b), Gulfport Harbor Navigation Project to USACE in 2007 (NMFS 2007b), East Pass dredging, Destin, Florida to USACE in 2009 (NMFS 2009a), Mississippi Coastal Improvements Program (federal restoration project) dredging and disposal of sand along West Ship Island barrier island to USACE in 2010 (NMFS 2010), Mississippi Coastal Improvements Program (federal restoration project) dredging and disposal of sand within Camille Cut to USACE in 2015 (NMFS 2015a), and dredging of City of Mexico Beach canal inlet (to USACE in 2012 (NMFS 2012a). Each of the above Opinions had its own ITS and determined that hopper dredging during the proposed action would not jeopardize any species of sea turtles or other listed species, or destroy or adversely modify critical habitat of any listed species.

5.2.1.2 Federal Vessel Activity

Watercraft are the greatest contributors to overall noise in the sea and have the potential to interact with sea turtles though direct impacts or propellers. Sound levels and tones produced are generally related to vessel size and speed. Larger vessels generally emit more sound than smaller vessels, and vessels underway with a full load, or those pushing or towing a load, are noisier than unladen vessels. Vessels operating at high speeds have the potential to strike sea turtles. Potential sources of adverse effects from federal vessel operations in the action area include operations of the BOEM, FERC, USCG, NOAA, and USACE.

Offshore Energy
NMFS has also conducted Section 7 consultations related to energy projects in the Gulf of Mexico (BOEM, FERC, and USCG) to implement conservation measures for vessel operations. Through the Section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. At the present time, they present the potential for some level of interaction.

Operations of vessels by other federal agencies within the action area (NOAA, BOEM) may adversely affect sea turtles. Yet, the in-water activities of those agencies are limited in scope, as they operate a limited number of vessels or are engaged in research/operational activities that are unlikely to contribute a large amount of risk.

5.2.1.3 Oil and Gas Exploration and Extraction

Federal and state oil and gas exploration, production, and development are expected to result in some sublethal effects to protected species, including impacts associated with the explosive removal of offshore structures, seismic exploration, marine debris, oil spills, and vessel operation. Many Section 7 consultations have been completed on BOEM oil and gas lease activities. Until 2002, these Opinions concluded only one sea turtle take may occur annually due to vessel strikes. Opinions issued on July 11, 2002 (NMFS 2002d), November 29, 2002 (NMFS 2002a), August 30, 2003 (Lease Sales 189 and 197 (NMFS 2003b), and June 29, 2007 (2007-2012 Five-Year Lease Plan (NMFS 2007a) have concluded that sea turtle takes may also result from vessel strikes, marine debris, and oil spills.

Explosive removal of offshore structures and seismic exploration may adversely affect sea turtles. In July 2004, BOEM completed a programmatic environmental assessment (PEA) on geological and geophysical exploration on the Gulf of Mexico Outer Continental Shelf (OCS). In an August 28, 2006 Opinion, NMFS issued incidental take for BOEM-permitted explosive structure removals (NMFS 2006a). On April 18, 2011, NMFS received a revised complete application from the BOEM requesting an authorization for the take of marine mammals incidental to seismic surveys on the OCS in the Gulf of Mexico [see (76 FR 34656), June 14, 2011]. NMFS intends to conduct a programmatic consultation with BOEM prior to issuing the requested MMPA authorization that will consider the effects to listed sea turtles for BOEM-authorized seismic activities throughout the northern Gulf of Mexico.

NMFS's June 29, 2007, Opinion issued to BOEM concluded that the 5-year leasing program for oil and gas development in the coastal and the Western Planning Areas of the Gulf of Mexico and its associated actions were not likely to jeopardize the continued existence of threatened or endangered species or destroy or adversely modify designated critical habitat (NMFS 2007a). NMFS estimated the number of listed species that could potentially experience adverse effects as the result of exposure to an oil spill over the lifetime of the action. However, as discussed below, on April 20, 2010, a massive oil well explosion and then subsequent release of oil at the DWH MC252 (*Deepwater Horizon*) well occurred. Given the effects of the spill, on July 30, 2010, BOEM requested reinitiation of interagency consultation under Section 7 of the ESA on the June 29, 2007, Opinion on the 5-Year OCS Oil and Gas Leasing Program (2007-2012) in the Central and Western Planning Areas of the Gulf of Mexico.

NMFS has begun synthesizing data from the spill, and it is clear that BOEM underestimated the size, frequency, and impacts associated with a catastrophic spill under the 2007-2012 lease sale program. The size and duration of the DWH oil spill (see following paragraph) were greater than anticipated, and the effects on listed species have exceeded NMFS's projections. Still, NMFS has not yet issued an Opinion concluding the reinitiated consultation.

Impact of Deepwater Horizon Oil Spill on Status of Sea Turtles
On April 20, 2010, while working on an exploratory well approximately 50 miles offshore Louisiana, the semi-submersible drilling rig DWH experienced an explosion and fire. The rig subsequently sank and oil and natural gas began leaking into the Gulf of Mexico. Oil flowed for 86 days, until the well was finally capped on July 15, 2010. Millions of barrels of oil were released into the Gulf. Additionally, approximately 1.84 million gallons of chemical dispersant was applied both subsurface and on the surface to attempt to break down the oil. There is no question that the unprecedented DWH event and associated response activities (e.g., skimming, burning, and application of dispersants) have resulted in adverse effects on listed sea turtles.

At this time, the total effects of the oil spill on species found throughout the Gulf of Mexico, including ESA-listed sea turtles, are not known. Potential DWH-related impacts to all sea turtle species include direct oiling or contact with dispersants from surface and subsurface oil and dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, loss of foraging resources which could lead to compromised growth and/or reproductive potential, harm to foraging, resting and/or nesting habitats, and disruption of nesting turtles and nests. Consequently, other than some emergency restoration efforts, most restoration efforts that occur pursuant to the Oil Pollution Act have yet to be determined and implemented, and so the ultimate restoration impacts on the species are unknowable at this time.

During the response phase to the DWH oil spill (April 26 – October 20, 2010) a total of 1,146 sea turtles were recovered, either as strandings (dead or debilitated generally onshore or nearshore) or were collected offshore during sea turtle search and rescue operations (Table 9). Subsequent to the response phase a few sea turtles with visible evidence of oiling have been recovered as strandings. The available data on sea turtle strandings and response collections during the time of the spill are expected to represent a fraction (currently unknown) of the actual losses to the species, as most individuals likely were not recovered. The number of strandings does not provide insights into potential sublethal impacts that could reduce long-term survival or fecundity of individuals affected. It does, however, provide some insight into the potential relative scope of the impact among the sea turtle species in the area. Kemp's ridley sea turtles may have been the most affected sea turtle species, as they accounted for almost 71% of all recovered turtles (alive and dead), and 79% of all dead turtles recovered. Green turtles accounted for 17.5% of all recoveries (alive and dead), and 4.8% of the dead turtles recovered. Loggerheads comprised 7.7% of total recoveries (alive and dead) and 11% of the dead turtle recovered. The remaining turtles were hawksbills and decomposed hardshell turtles that were not identified to species. No leatherbacks were among the sea turtles recovered in the spill response area. (Note: Leatherbacks were documented in the spill area, but they were not recovered alive or dead).

Table 9. Sea Turtles Recovered in the DWH Spill Response Area (April 26 – October 20, 2010)

Turtle Species	Alive	Dead	Total
Green turtle (*Chelonia mydas*)	172	29	201
Hawksbill turtle (*Eretmochelys imbricata*)	16	0	16
Kemp's ridley turtle (*Lepidochelys kempii*)	328	481	809
Loggerhead turtle (*Caretta caretta*)	21	67	88
Unknown turtle species	0	32	32
Total	537	609	1146

(http://www.nmfs.noaa.gov/pr/health/oilspill/turtles.htm)

Although extraordinarily high numbers of threatened and endangered sea turtles were documented stranded (primarily within Mississippi Sound), during the DWH oil spill the vast majority of sea turtles recovered by the stranding network have shown no visible signs of oil. The DWH oil spill event increased awareness and human presence in the northern Gulf of Mexico, which likely resulted in some of the increased reporting of stranded turtles to the stranding network; however, we do not believe this factor fully explains the increases observed in 2010. We believe some of the increases in strandings may have been attributed to bycatch mortality in the shrimp fishery. As a result, on August 16, 2010, NMFS reinitiated Section 7 consultation on Southeast state and federal shrimp fisheries based on a high level of strandings, elevated nearshore sea turtle abundance as measured by trawl catch per unit of effort, and lack of compliance with TED requirements. These factors indicated sea turtles may be affected by shrimp trawling to an extent not previously considered in the 2002 shrimp Opinion.

Another period of high stranding levels occurred in 2011, similar to that in 2010. Investigations, including necropsies, were undertaken by NMFS to attempt to determine the cause of those strandings. Based on the findings, the 2 primary considerations for the cause of death of the turtles that were necropsied are forced submergence or acute toxicosis. With regard to acute toxicosis, sea turtle tissue samples were tested for biotoxins of concern in the northern Gulf of Mexico. Environmental information did not indicate a harmful algal bloom of threat to marine animal health was present in the area. With regard to forced submergence, the only known plausible cause of forced submergence that could explain this event is incidental capture in fishing gear. NMFS has assembled information regarding fisheries operating in the area during and just prior to these strandings. While there is some indication that lack of compliance with existing TED regulations and the operations of other trawl fisheries that do not require TEDs may have occurred in the area at the time of the strandings, direct evidence that those events caused the unusual level of strandings is not available. More information on the stranding event, including number of strandings, locations, and species affected, can be found at http://www.nmfs.noaa.gov/pr/species/turtles/gulfofmexico.htm.

In addition to effects on subadult and adult sea turtles, the 2010 May through September sea turtle nesting season in the northern Gulf may also have been adversely affected by the DWH oil spill. Setting booms to protect beaches, cleanup activities, lights, people, and equipment all may have had unintended effects, such as preventing females from reaching nesting beaches and thereby reducing nesting in the northern Gulf.

The oil spill may also have adversely affected emergence success. In the northern Gulf area, approximately 700 nests are laid annually in the Florida Panhandle and up to 80 nests are laid annually in Alabama. Most nests are made by loggerhead sea turtles; however, a few Kemp's ridley and green turtle nests were also documented in 2010. Hatchlings begin emerging from nests in early to mid-July; the number of hatchlings estimated to be produced from northern Gulf sea turtle nests in 2010 was 50,000. To try to avoid the loss of most, if not all, of 2010's northern Gulf of Mexico hatchling cohort, all sea turtle nests laid along the northern Gulf Coast were visibly marked to ensure that nests were not harmed during oil spill cleanup operations that are undertaken on beaches. In addition, a sea turtle late-term nest collection and hatchling release plan was implemented to provide the best possible protection for sea turtle hatchlings emerging from nests in Alabama and the Florida Panhandle. Starting in June, northern Gulf nests were relocated to the Atlantic to provide the highest probability of reducing the anticipated risks to hatchlings as a result of the DWH oil spill. A total of 274 nests, all loggerheads except for 4 green turtle and 5 Kemp's ridley nests, were translocated just prior to emergence from northern Gulf of Mexico beaches to the east coast of Florida so that the hatchlings could be released in areas not affected by the oil spill (Table 10). In mid-August, it was determined that the risks to hatchlings emerging from beaches and entering waters off the northern Gulf Coast had diminished significantly, and all nest translocations were ceased by August 19, 2010.

Table 10. Number of Turtle Nests Translocated from the Gulf Coast and Hatchlings Released in the Atlantic Ocean

Turtle Species	Translocated Nests	Hatchlings Released
Green turtle (*Chelonia mydas*)	4	455
Kemp's ridley turtle (*Lepidochelys kempii*)	5	125
Loggerhead turtle (*Caretta caretta*)	265*	14,216

The sea turtle nest translocation effort ceased on August 19, 2010.
*Does not include 1 nest that included a single hatchling and no eggs.
(http://www.nmfs.noaa.gov/pr/health/oilspill/turtles.htm)

The survivorship and future nesting success of individuals from one nesting beach being transported to and released at another nesting beach is unknown. The loggerheads nesting and emerging from nests in the Florida Panhandle and Alabama are part of the Northern Gulf of Mexico Recovery Unit (NGMRU) and differ genetically from loggerheads produced along the Atlantic Coast of Florida, but they are part of NWA Ocean DPS. Evidence suggests that some portion of loggerheads produced on Northern Gulf beaches are transported naturally into the Atlantic by currents and spend portions of their life cycles away from the Gulf of Mexico. This is based on the presence of some loggerheads with a northern Gulf of Mexico genetic signature in the Atlantic. These turtles are assumed to make their way back to the Gulf of Mexico as subadults and adults. It is unknown what the impact of the nesting relocation efforts will be on the NGMRU in particular, or the NWA DPS generally.

Loggerhead nesting in the northern Gulf of Mexico represents a small proportion of overall Florida loggerhead nesting and an even smaller proportion of the NWA Ocean DPS. The 5-year average (2006-2010) for the statewide number of loggerhead nests in the state of Florida is 56,483 nests annually (Florida Fish and Wildlife Conservation Commission nesting database) versus an average of well under 1,000 nests per year for the northern Gulf of Mexico (approximately 700 in 2010). We do not know what the impact of relocating 265 nests will be on the 2010 nesting cohort compared to the total of approximately 700 nests laid on Northern Gulf beaches. While there may be a risk of possible increased gene flow across loggerhead recovery units, all are within the NWA Ocean DPS and would likely not be on a scale of conservation concern. Recovery units are subunits of the listed species that are geographically or otherwise identifiable and essential to the recovery of the species. Recovery units are individually necessary to conserve genetic robustness, demographic robustness, important life history stages, or some other feature necessary for long-term sustainability of the species. Recovery units are not necessarily self-sustaining viable units on their own, but instead need to be collectively recovered to ensure recovery of the entire listed entity. Recovery criteria must be met for all recovery units identified in the Recovery Plan before the NWA DPS can be considered for delisting.

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

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

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

Available information indicates hawksbill and leatherback sea turtles were least affected, at least directly, by the oil spill. Potential DWH-related impacts to leatherback sea turtles include direct oiling or contact with dispersants from surface and subsurface oil and dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

5.2.1.4 ESA Permits

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

5.2.1.5 Fisheries

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

For all federal fisheries for which there is a Fishery Management Plan (FMP), impacts have been evaluated under Section 7. Formal Section 7 consultations have been conducted on the following fisheries, occurring at least in part within the action area, found likely to adversely affect threatened and endangered sea turtles: Southeast shrimp trawl fisheries, Atlantic Highly Migratory Species (HMS) PLL, HMS directed shark, reef fish, and coastal migratory pelagic resources (CMPR) fisheries.

Southeast shrimp trawl fisheries

Formal consultation has previously been conducted on Southeast shrimp fisheries, most recently in 2014. Although there are many different fisheries that affect sea turtles, shrimp trawling is believed to have had the greatest adverse effect on sea turtles in the action area in the past.

Shrimp trawling increased dramatically in the action area between the 1940s and the 1960s. By the late 1970s, there was evidence thousands of sea turtles were being killed annually in the Southeast (Henwood and Stuntz 1987). In 1990, the NRC concluded the Southeast shrimp trawl fishery affected more sea turtles than all other activities combined and was the most significant man-made source of sea turtle mortality in the U.S. waters, in part due to the high reproductive value of turtles taken in this fishery (NRC 1990a).

The level of annual mortality described in NRC (1990a) is believed to have continued until 1992-1994, when U.S. law required all shrimp trawlers in the Atlantic and Gulf of Mexico to use turtle excluder devices (TEDs), which allowed some turtles to escape nets before drowning (NMFS 2002b). TEDs approved for use have had to demonstrate 97% effectiveness in excluding sea turtles from trawls in controlled testing. Despite the apparent success of TEDs for some species of sea turtles (e.g., Kemp's ridleys), it was later discovered that TEDs were not adequately protecting all species and size classes of sea turtles. Analyses by Epperly and Teas (2002) indicated that the minimum requirements for the escape opening dimension in TEDs in use at that time were too small for some sea turtles and that as many as 47% of the loggerheads stranding annually along the Atlantic and Gulf of Mexico were too large to fit the existing openings. In February 2003, NMFS implemented revisions to the TED regulations addressing that problem [(68 FR 8456), February 21, 2003]. The revised TED regulations were expected to reduce shrimp trawl related mortality by 94% for loggerheads and 97% for leatherbacks.

Interactions between sea turtles and otter trawls in the years leading up to the May 8, 2012 consultation were thought to be declining because of reductions in fishing effort that were unrelated to fisheries management actions, as well as improvements in TED designs (NMFS 2012b). Low shrimp prices, rising fuel costs, competition with imported products, and the impacts of hurricanes in the Gulf of Mexico have all impacted shrimp fleets; in some cases reducing fishing effort by as much as 50% in offshore waters of the Gulf of Mexico (GMFMC 2007). For example, the estimated annual number of interactions and mortalities between sea turtles and shrimp trawls in the Gulf shrimp fisheries (state and federal) under the new regulation [(68 FR 8456), February 21, 2003] based on Epperly et al. (2002) estimated CPUEs and 2007 effort data in Nance et al. (2008) were significantly less than predicted in the 2002 Opinion (Table 11).

Table 11. Estimated Annual Number of Interactions between Sea Turtles and Shrimp Trawls in the Gulf of Mexico Shrimp Fisheries Associated (Estimated Mortalities Based on 2007 Gulf Effort Data Taken from Nance et al. (2008))

Species	Estimated Interactions	Estimated Mortalities
Leatherback	520	15
Loggerhead	23,336	647
Kemp's ridley	98,184	2,716
Green	11,311	319

(December 8, 2008, Memorandum from Dr. Ponwith to Dr. Crabtree, NMFS; Data Analysis Request: Update of turtle bycatch in the Gulf of Mexico shrimp fishery.)

On August 16, 2010, reinitiation of consultation on sea turtle effects was triggered by elevated strandings in the Northern Gulf of Mexico suspected to be attributable to shrimp trawling, compliance concerns with TED and tow-time regulations, and elevated nearshore sea turtle abundance trawl catch per unit of effort (CPUE). These factors collectively indicated that sea turtles were being affected by shrimp trawling, under the sea turtle conservation regulations and federal FMPs, to an extent not considered in the 2002 Opinion, despite lower fishing effort levels.

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

Subsequent to the completion of this Opinion, NMFS withdrew the proposed amendment to require TEDs in skimmer trawls, pusher-head trawls, and wing nets. Consequently, NMFS reinitiated consultation on November 26, 2012. Consultation was completed in April 2014 and determined the continued implementation of the sea turtle conservation regulations and the continued authorization of the Southeast U.S. shrimp fisheries in federal waters under the MSFCMA was not likely jeopardize the continued existence of any sea turtle species. The ITS maintained the use of anticipated trawl effort and fleet TED compliance as surrogates for numerical sea turtle takes.

Atlantic pelagic longline fisheries

Atlantic PLL fisheries targeting swordfish and tuna are also known to incidentally capture and kill large numbers of loggerhead and leatherback sea turtles. U.S. PLL fishers began targeting HMS in the Atlantic Ocean in the early 1960s. The fishery is comprised of 5 relatively distinct segments, including: the Gulf yellowfin tuna fishery (the only segment in our action area); southern Atlantic (Florida East Coast to Cape Hatteras) swordfish fishery; Mid-Atlantic and New England swordfish and bigeye tuna fishery; U.S. Atlantic Distant Water swordfish fishery; and the Caribbean tuna and swordfish fishery. Pelagic longlines targeting yellowfin tunas in the Gulf are set in the morning (pre-dawn) in deep water and hauled in the evening. Although this fishery does occur in the action area, fishing occurs further offshore than where shrimp trawling occurs. The fishery mainly interacts with leatherback sea turtles and pelagic juvenile loggerhead sea turtles, thus, younger, smaller loggerhead sea turtles than the other fisheries described in this environmental baseline.

Over the past 2 decades, NMFS has conducted numerous consultations on this fishery, some of which required RPAs to avoid jeopardy of loggerhead and/or leatherback sea turtles. The estimated historical total number of loggerhead and leatherback sea turtles caught between 1992-2002 (all geographic areas) is 10,034 loggerhead and 9,302 leatherback sea turtles of which 81 and 121 were estimated to be dead when brought to the vessel (NMFS 2004). This does not account for post-release mortalities, which historically were likely substantial.

NMFS reinitiated consultation in 2003 on PLL fisheries as a result of exceeded incidental take levels for loggerheads and leatherbacks (NMFS 2004). The resulting 2004 Opinion stated the long-term continued operation of this sector of the fishery was likely to jeopardize the continued existence of leatherback sea turtles, but RPAs were implemented allowing for the continued authorization of PLL fishing that would not jeopardize leatherback sea turtles.

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

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

Gulf of Mexico Reef Fish Fishery
The Gulf of Mexico reef fish fishery uses 2 basic types of gear: spear or powerhead, and hook-and-line gear. Hook-and-line gear used in the fishery includes both commercial bottom longline and commercial and recreational vertical line (e.g., handline, bandit gear, rod-and-reel).

Prior to 2008, the reef fish fishery was believed to have a relatively moderate level of sea turtle bycatch attributed to the hook-and-line component of the fishery (i.e., approximately 107 captures and 41 mortalities annually, all species combined, for the entire fishery) (NMFS 2005a). In 2008, SEFSC observer programs and subsequent analyses indicated that the overall amount and extent of incidental take for sea turtles specified in the ITS of the 2005 Opinion on the reef fish fishery had been severely exceeded by the bottom longline component of the fishery (approximately 974 captures and at least 325 mortalities estimated for the period July 2006-2007).

In response, NMFS published an emergency rule prohibiting the use of bottom longline gear in the reef fish fishery shoreward of a line approximating the 50-fathom depth contour in the eastern Gulf of Mexico, essentially closing the bottom longline sector of the reef fish fishery in the eastern Gulf of Mexico for 6 months pending the implementation of a long-term management strategy. The Gulf of Mexico Fishery Management Council (GMFMC) developed a long-term management strategy via a new amendment (Amendment 31 to the Reef Fish FMP). The amendment included a prohibition on the use of bottom longline gear in the Gulf of Mexico reef fish fishery, shoreward of a line approximating the 35-fathom contour east of Cape San Blas, Florida, from June through August; a reduction in the number of bottom longline vessels operating in the fishery via an endorsement program; and a restriction on the total number of hooks that may be possessed onboard each Gulf of Mexico reef fish bottom longline vessel to 1,000, only 750 of which may be rigged for fishing.

On October 13, 2009, SERO completed an opinion that analyzed the expected effects of the continued operation of the Gulf of Mexico reef fish fishery under the changes proposed in Amendment 31 (NMFS-SEFSC 2009b). The Opinion concluded that sea turtle takes would be substantially reduced compared to the fishery as it was previously prosecuted, and that operation of the fishery would not jeopardize the continued existence of any sea turtle species. Amendment 31 was implemented on May 26, 2010. In August 2011, consultation was reinitiated to address the DWH oil spill event and potential changes to the environmental baseline. Reinitiation of consultation was not related to any material change in the fishery itself, violations of any terms and conditions of the 2009 Opinion or exceedance of the ITS. The resulting September 11, 2011 Opinion concluded the continued operation of the Gulf reef fish fishery is not likely to jeopardize the continued existence of any listed sea turtles, and an ITS was provided (NMFS 2011).

South Atlantic Snapper-Grouper Fishery

The South Atlantic snapper-grouper fishery uses spear and powerheads, black sea bass pots, and hook-and-line gear. Hook-and-line gear used in the fishery includes commercial bottom longline gear and commercial and recreational vertical line gear (i.e., handline, bandit gear, and rod-and-reel. On December 1, 2016, NMFS completed its most recent biological opinion on the snapper grouper fishery of the South Atlantic Region (NMFS 2016). In this biological opinion, NMFS concluded that the snapper grouper fishery's continued authorization is likely to adversely affect but is not likely to jeopardize the continued existence of the NARW, loggerhead sea turtle Northwest Atlantic DPS, leatherback sea turtle, Kemp's ridley sea turtle, green sea turtle North Atlantic DPS, green sea turtle South Atlantic DPS, hawksbill sea turtle, smalltooth sawfish U.S. DPS, or Nassau grouper. NMFS also concluded that designated critical habitat and other ESA-listed species in the South Atlantic Region were not likely to be adversely affected.

The black seas bass pot component of the snapper-grouper fishery is the only component of the fishery that may adversely affect NARWs; effects from all the other gear types were discounted in the biological opinion. Sea turtles, smalltooth sawfish, and Nassau grouper adversely affected by the bottom longline and vertical hook-and-line gear components of the fishery. The consultation concluded the proposed action was not likely to jeopardize the continued existence of any of these species, and an ITS was provided.

Atlantic HMS Directed Shark Fisheries

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

Growing demand for shark and shark products encouraged expansion of the commercial shark fishery through the 1970s and 1980s. As catches accelerated through the 1980s, shark stocks started to show signs of decline. Peak commercial landings of large coastal and pelagic sharks were reported in 1989.

Atlantic LCS, SCS, and pelagic sharks have been managed by NMFS since the 1993 under an FMP for Atlantic Sharks. At that time, NMFS identified LCS as overfished and implemented commercial quotas for LCS (2,436 metric tons [mt] dressed weight) and established recreational harvest limits for all sharks. In 1994, under the rebuilding plan implemented in the 1993 Shark FMP, the LCS quota was increased to 2,570 mt dressed weight; in 1997, NMFS reduced the LCS commercial quota by 50% to 1,285 mt dressed weight and the recreational retention limit to 2 LCS, SCS, and pelagic sharks combined per trip with an additional allowance of 2 Atlantic sharpnose sharks per person, per trip (62 FR 16648), April 2, 1997). Since 1997, the directed LCS fishing season was generally open for the first 3 months of the year and then a few weeks in July/August.

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

In 2008, NMFS completed a Section 7 consultation on the continued authorization of directed Atlantic HMS shark fisheries under the Consolidated HMS FMP, including Amendment 2 (NMFS 2008). To protect declining shark stocks, Amendment 2 sought to greatly reduce the fishing effort in the commercial component of the fishery. These effort reductions are believed to have greatly reduced the interactions between the commercial component of the fishery and sea turtles. Amendment 2 to the Consolidated HMS FMP (73 FR 35778), June 24, 2008, corrected at (73 FR 40658), July 15, 2008) established, among other things, a shark research fishery to maintain time series data for stock assessments and to meet NMFS's 2009 research objectives. The shark research fishery permits authorize participation in the shark research fishery and the collection of sandbar and non-sandbar LCS from federal waters in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea for the purposes of scientific data collection subject to 100% observer coverage. The commercial vessels selected to participate in the shark research fishery are the only vessels authorized to land/harvest sandbars subject to the sandbar quota available for each year. The base quota was 87.9 mt dressed weight per year through December 31, 2012, and has been 116.6 mt dressed weight/year since January 1, 2013. The selected vessels have access to the non-sandbar LCS, SCS, and pelagic shark quotas. Commercial vessels not participating in the shark research fishery are subject to 4-6% observer coverage and may only land non-sandbar LCS, SCS, and pelagic sharks subject to the retention limits and quotas per 50 CFR 635.24 and 635.27, respectively.

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

The most recent ESA Section 7 consultation was completed on December 12, 2012, on the continued operation of shark fisheries and Amendments 3 and 4 to the Consolidated HMS FMP (NMFS 2012). Amendment 3 to the Consolidated HMS FMP (74 FR 36892 2009); July 24, 2009) implemented measures to bring smoothhound sharks under federal management and end overfishing of blacknose and shortfin mako sharks. The amendment also implemented measures to rebuild blacknose sharks consistent with the 2007 SCS stock assessment, the MSFCA, and other domestic law. Amendment 4 to the Consolidated HMS FMP amended HMS fishery management regulations related to Atlantic sharks in the U.S. Caribbean to address substantial differences between some segments of the U.S. Caribbean HMS fisheries and the HMS fisheries that occur off the mainland of the United States. The 2012 shark Opinion analyzed the potential adverse effects from the smoothhound fishery on sea turtles for the first time. Few smoothhound trips have been observed and no sea turtle captures have been documented in the smoothhound fishery. The Opinion concluded the entire proposed action was not likely to jeopardize the continued existence of sea turtles, and an ITS was provided.

Coastal Migratory Pelagic Resources Fishery

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

On November 26, 2012, NMFS requested reinitiation of consultation to evaluate the potential impact of this fishery on the recently listed 5 DPSs of Atlantic sturgeon. On June 18, 2015, NMFS completed Section 7 consultation on the CMPR fishery, and issued an ITS for takes in the federal CMP fisheries (NMFS 2015b).

Spiny Lobster Fishery
NMFS completed a Section 7 consultation on the Gulf and South Atlantic Spiny Lobster FMP on August 27, 2009 [i.e., (NMFS 2009b)]. The commercial component of the fishery consists of diving, bully net and trapping sectors; recreational fishers are authorized to use bully net and hand-harvest gears. Of the gears used, only traps are expected to result in adverse effects on sea turtles. The consultation determined the continued authorization of the fishery would not jeopardize any listed species. An ITS was issued for takes in the commercial trap sector of the fishery. Fishing activity is limited to waters off south Florida and, although the FMP does authorize the use of traps in federal waters, historic and current effort is very limited. Thus, potential adverse effects on sea turtles are believed to also be very limited (e.g., no more than a couple sea turtle entanglements annually).

Stone Crab Fishery
NMFS completed a Section 7 consultation on the Gulf of Mexico Stone Crab FMP on September 28, 2009 (NMFS 2009b). The commercial component of the fishery is traps; recreational fishers use traps or wade/dive for stone crabs. Of the gears used, only commercial traps are expected to result in adverse effects on sea turtles. The number of commercial traps actually in the water is very difficult to estimate, and the number of traps used recreationally is unquantifiable with any degree of accuracy. The consultation determined the continued authorization of the fishery was likely to adversely affect sea turtles, but would not jeopardize their continued existence; an ITS was issued for takes in the commercial trap sector of the fishery. On October 28, 2011, NMFS repealed the federal FMP for this fishery, and the fishery is now managed exclusively by the State of Florida.

Dolphin/Wahoo Fishery
The South Atlantic FMP for the dolphin/wahoo fishery was approved in December 2003. The stated purpose of the Dolphin and Wahoo FMP is to adopt precautionary management strategies to maintain the current harvest level and historical allocations of dolphin (90% recreational) and ensure no new fisheries develop. At that time, HMS pelagic logline vessels were also fishing for dolphin using small hooks attached to their surface buoys. NMFS conducted a formal Section 7 consultation to consider the effects on sea turtles of authorizing fishing under the FMP (NMFS 2003c). The August 27, 2003 Opinion concluded that green, hawksbill, Kemp’s ridley, leatherback, and loggerhead sea turtles may be adversely affected by the longline component of the fishery, but it was not expected to jeopardize their continued existence. An ITS for sea turtles was provided with the Opinion. Pelagic longline vessels can no longer target dolphin/wahoo with smaller hooks because of hook size requirements in the PLL fishery; thus, little longline effort targeting dolphin is currently believed to be present in the action area.

5.2.2 State or Private Actions

5.2.2.1 State Fisheries

Various fishing methods used in state commercial and recreational fisheries, including gillnets, fly nets, trawling, pot fisheries, pound nets, and vertical line are all known to incidentally take sea turtles, but information on these fisheries is sparse (NMFS 2001). Most of the state data are based on extremely low observer coverage, or sea turtles were not part of data collection; thus, these data provide insight into gear interactions that could occur but are not indicative of the magnitude of the overall problem.

Gillnet Fisheries
A detailed summary of the gillnet fisheries currently operating along the Gulf of Mexico, which are known to incidentally capture loggerheads, can be found in the TEWG reports (1998; 2000). Louisiana, Mississippi, and Alabama have placed restrictions on gillnet fisheries within state waters such that very little gillnetting takes place.

Trawl Fisheries
On February 15, 2007, NMFS published an advanced notice of proposed rulemaking (ANPR) regarding potential amendments to the regulatory requirements for TEDs (72 FR 7382 2007). The objective of the proposed measures were to effectively protect all life stages and species of sea turtle in Atlantic and Gulf of Mexico trawl fisheries where they are vulnerable to incidental capture and mortality. On June 24, 2011, NMFS published a proposed Rule stating its intent to prepare an EIS and conduct public scoping meetings regarding potential amendments to the regulatory requirements for TEDs (76 FR 37050 2011). Scoping meetings were held from July 12-18, 2011, in Louisiana, Mississippi, Alabama, and North Carolina, but a Draft Environmental Impact Statement was never published. Ultimately, NMFS decided more research and development on TEDs for these fisheries was needed prior to any regulatory proposals and is focusing on those efforts.

Fixed Net Fisheries
Beyond commercial fisheries, observations of state recreational fisheries have shown that loggerhead, leatherback, Kemp's ridley, and green sea turtles are known to bite baited hooks, and loggerheads and Kemp's ridleys frequently ingest the hooks. Data reported through Marine Recreational Fisheries Statistics Survey (MRFSS) and STSSN show recreational fishers have hooked sea turtles when fishing from boats, piers, and beach, banks, and jetties.

Although few of these state regulated fisheries are currently authorized to incidentally take listed species, several state agencies have approached NMFS to discuss applications for a Section 10(a)(1)(B) incidental take permit. Since NMFS's issuance of a Section 10(a)(1)(B) permit requires formal consultation under Section 7 of the ESA, any fisheries that come under a Section 10(a)(1)(B) permit in the future will likewise be subject to Section 7 consultation. Although the past and current effects of these fisheries on listed species are currently not determinable, NMFS believes that ongoing state fishing activities may be responsible for seasonally high levels of observed strandings of sea turtles on Gulf of Mexico coasts.

5.2.2.2 Vessel Traffic

Commercial traffic and recreational boating pursuits can have adverse effects on sea turtles via propeller and boat strike damage. The STSSN includes many records of vessel interactions (propeller injury) with sea turtles off Gulf of Mexico.

Data show that vessel traffic is one cause of sea turtle mortality (Hazel and Gyuris 2006; Lutcavage et al. 1997; MSS 2003). Stranding data for the Gulf of Mexico coast show that vessel-related injuries are noted in stranded sea turtles.[8] Data indicate that live- and dead-stranded sea turtles showing signs of vessel-related injuries continue in a high percentage of stranded sea turtles in coastal regions of the southeastern United States. Although the USACE-permitted docks and boatlifts may determine the location of recreational vessels, for most projects the docks themselves are not believed to result in increases of the number recreational vessels on the water.

5.2.3 Other Potential Sources of Impacts in the Environmental Baseline

5.2.3.1 Marine Debris and Acoustic Impacts

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

5.2.3.2 Marine Pollution and Environmental Contamination

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

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

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[8] STSSN. 2016. Sea Turtle Stranding and Salvage Network (STSSN). http://www.sefsc.noaa.gov/species/turtles/strandings.htm. Last updated on 07/09/2016. Accessed 07/14/2016.

The Gulf of Mexico is an area of high-density offshore oil extraction with chronic, low-level spills and occasional massive spills (such as the recent DWH oil spill, Ixtoc I oil well blowout and fire in the Bay of Campeche in 1979, and the explosion and destruction of a loaded supertanker, the Mega Borg, near Galveston in 1990). Oil spills can impact wildlife directly through 3 primary pathways: ingestion – when animals swallow oil particles directly or consume prey items that have been exposed to oil, absorption – when animals come into direct contact with oil, and inhalation – when animals breath volatile organics released from oil or from "dispersants" applied by response teams in an effort to increase the rate of degradation of the oil in seawater. Several aspects of sea turtle biology and behavior place them at particular risk, including the lack of avoidance behavior, indiscriminate feeding in convergence zones, and large pre dive inhalations (Milton et al. 2003). When large quantities of oil enter a body of water, chronic effects such as cancer, and direct mortality of wildlife becomes more likely (Lutcavage et al. 1997). Oil spills in the vicinity of nesting beaches just prior to or during the nesting season could place nesting females, incubating egg clutches, and hatchlings at significant risk (Fritts and McGehee 1982; Lutcavage et al. 1997; Witherington 1999). Continuous low-level exposure to oil in the form of tar balls, slicks, or elevated background concentrations also challenge animals facing other natural and anthropogenic stresses. Types of trauma can include skin irritation, altering of the immune system, reproductive or developmental damage, and liver disease (Keller et al. 2004; Keller et al. 2006). Chronic exposure may not be lethal by itself, but it may impair a turtle's overall fitness so that it is less able to withstand other stressors (Milton et al. 2003).

The earlier life stages of living marine resources are usually at greater risk from an oil spill than adults. This is especially true for hatchlings, since they spend a greater portion of their time at the sea surface than adults; thus, their risk of exposure to floating oil slicks is increased (Lutcavage et al. 1995). One of the reasons might be the simple effects of scale: for example, a given amount of oil may overwhelm a smaller immature organism relative to the larger adult. The metabolic machinery an animal uses to detoxify or cleanse itself of a contaminant may not be fully developed in younger life stages. Also, in early life stages, animals may contain proportionally higher concentrations of lipids, to which many contaminants such as petroleum hydrocarbons bind. Most reports of oiled hatchlings originate from convergence zones, ocean areas where currents meet to form collection points for material at or near the surface of the water.

Unfortunately, little is known about the effects of dispersants on sea turtles, and such impacts are difficult to predict in the absence of direct testing. While inhaling petroleum vapors can irritate turtles' lungs, dispersants can interfere with lung function through their surfactant (detergent) effect. Dispersant components absorbed through the lungs or gut may affect multiple organ systems, interfering with digestion, respiration, excretion, and/or salt-gland function—similar to the empirically demonstrated effects of oil alone (Shigenaka et al. 2003). Oil cleanup activities can also be harmful. Earth-moving equipment can dissuade females from nesting and destroy nests, containment booms can entrap hatchlings, and lighting from nighttime activities can misdirect turtles (Witherington 1999).

There are studies on organic contaminants and trace metal accumulation in green and leatherback sea turtles (Aguirre et al. 1994; Caurant et al. 1999; Corsolini et al. 2000). Mckenzie et al.

(1999) measured concentrations of chlorobiphenyls and organochlorine pesticides in sea turtles tissues collected from the Mediterranean (Cyprus, Greece) and European Atlantic waters (Scotland) between 1994 and 1996. Omnivorous loggerhead turtles had the highest organochlorine contaminant concentrations in all the tissues sampled, including those from green and leatherback turtles (Storelli et al. 2008). It is thought that dietary preferences were likely to be the main differentiating factor among species. Decreasing lipid contaminant burdens with turtle size were observed in green turtles, most likely attributable to a change in diet with age. Sakai et al. (1995) found the presence of metal residues points for material at or near the surface of the water. Sixty-five of 103 post-hatchling loggerheads in convergence zones off Florida's east coast were found with tar in the mouth, esophagus or stomach (Loehefener et al. 1989). Thirty-four percent of post-hatchlings captured in *Sargassum* off the Florida coast had tar in the mouth or esophagus and more than 50% had tar caked in their jaws (Witherington 1994). These zones aggregate oil slicks, such as a Langmuir cell, where surface currents collide before pushing down and around, and represents a virtually closed system where a smaller weaker sea turtle can easily become trapped (Carr 1987; Witherington 2002). Lutz (1989) reported that hatchlings have been found apparently starved to death, their beaks and esophagi blocked with tarballs. Hatchlings sticky with oil residue may have a more difficult time crawling and swimming, rendering them more vulnerable to predation.

Frazier (1980) suggested that olfactory impairment from chemical contamination could represent a substantial indirect effect in sea turtles, since a keen sense of smell apparently plays an important role in navigation and orientation. A related problem is the possibility that an oil spill impacting nesting beaches may affect the locational imprinting of hatchlings, and thus impair their ability to return to their natal beaches to breed and nest (Milton et al. 2003). Whether hatchlings, juveniles, or adults, tar balls in a turtle's gut are likely to have a variety of effects – starvation from gut blockage, decreased absorption efficiency, absorption of toxins, effects of general intestinal blockage (such as local necrosis or ulceration), interference with fat metabolism, and buoyancy problems caused by the buildup of fermentation gases (floating prevents turtles from feeding and increases their vulnerability to predators and boats), among others. Also, trapped oil can kill the seagrass beds that turtles feed upon.

As mentioned above, little is known about the effects of dispersants on sea turtles, and such impacts are difficult to predict in the absence of direct testing. Dispersant components absorbed through the lungs or gut may affect multiple organ systems, interfering with digestion, respiration, excretion occurring in loggerhead turtle organs and eggs. Storelli et al. (2008) analyzed tissues from 12 loggerhead sea turtles stranded along the Adriatic Sea (Italy) and found that characteristically, mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals and porpoises (Law et al. 1991). No information on detrimental threshold concentrations is available, and little is known about the consequences of exposure of organochlorine compounds to sea turtles. Research is needed on the short- and long-term health and fecundity effects of chlorobiphenyl, organochlorine, and heavy metal accumulation in sea turtles.

Nutrient loading from land-based sources, such as coastal communities and agricultural operations, are known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. An example is the large area of the Louisiana continental shelf with seasonally depleted oxygen levels (< 2 mg/Liter) is caused by eutrophication from both point and non-point sources. Most aquatic species cannot survive at such low oxygen levels and these areas are known as "dead zones." The oxygen depletion, referred to as hypoxia, begins in late spring, reaches a maximum in mid-summer, and disappears in the fall. Since 1993, the average extent of mid-summer, bottom-water hypoxia in the northern Gulf of Mexico has been approximately 16,000 km^2, approximately twice the average size measured between 1985 and 1992. The hypoxic zone attained a maximum measured extent in 2002, when it was about 22,000 km^2—larger than the state of Massachusetts (USGS 2005). The hypoxic zone has impacts on the animals found there, including sea turtles, and the ecosystem-level impacts continue to be investigated.

5.2.4 Conservation and Recovery Actions Benefiting Sea Turtles

NMFS has implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles from commercial fisheries in the action area. These include sea turtle release gear requirements for Gulf of Mexico reef fish and TED requirements for the Southeast shrimp trawl fisheries. These regulations have relieved some of the pressure on sea turtle populations.

Under Section 6 of the ESA, NMFS may enter into cooperative research and conservation agreements with states to assist in recovery actions of listed species. NMFS has agreements with all states in the action area. Prior to issuance of these agreements, the proposal must be reviewed for compliance with Section 7 of the ESA.

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

Other Actions
Five-year status reviews were completed in 2007 for green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. These reviews were conducted to comply with the ESA mandate for periodic status evaluation of listed species to ensure that their threatened or endangered listing status remains accurate. Each review determined that no delisting or reclassification of a species status (i.e., threatened or endangered) was warranted at this time. Further review of species data for the green, hawksbill, leatherback, and loggerhead sea turtles was recommended to evaluate whether DPSs should be established for these species (NMFS and USFWS 2007a; NMFS and USFWS 2007b; NMFS and USFWS 2007c; NMFS and USFWS 2007d; NMFS and USFWS 2007e). The Services completed a revised recovery plan for the loggerhead sea turtle on December 8, 2008 (NMFS and USFWS 2008) and published a Final Rule on September 22, 2011, listing loggerhead sea turtles as separate DPSs. Also, on April 6, 2016, NMFS and the USFWS published a Final Rule (81 FR 20057 2016) removing the range-wide and breeding population ESA listings of the green sea turtle, and in their place, listing 8 DPSs as threatened and 3 DPSs as endangered, effective May 6, 2016. Two of the green sea turtle DPSs, the North Atlantic DPS and the South Atlantic DPS, occur in the Caribbean and are listed as threatened. A revised recovery plan for the Kemp's ridley sea turtle was completed on

September 22, 2011. On October 10, 2012, NMFS announced initiation of 5-year reviews of Kemp's ridley (*Lepidochelys kempii*), olive ridley (*Lepidochelys olivacea*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*) sea turtles and requested submission of any pertinent information on those sea turtles that has become since their last status review in 2007.

5.2.5 Summary and Synthesis of Environmental Baseline for Sea Turtles

In summary, several factors adversely affect sea turtles in the action area. These factors are ongoing and are expected to occur contemporaneously with the proposed action. Dredging in the action area likely had the greatest adverse impacts on sea turtles in the mid- to late-80s, when most maintenance dredge activity was being conducted without current conservation measures. Since the late-90s, the impacts associated with maintenance dredging have been reduced through the Section 7 consultation process and regulations implementing effective conservation strategies. Other environmental impacts including effects of fishing operations, vessel operations, oil and gas exploration, permits allowing take under the ESA, private vessel traffic, and marine pollution have also had and continue to have adverse effects on sea turtles in the action area in the past. The recent DWH oil spill event is expected to have had an adverse impact on the baseline for sea turtles, but the extent of that impact is not yet well understood.

5.3 Factors Affecting Gulf Sturgeon in the Action Area

As stated in Section 3.2 (Action Area), the action area includes the Mississippi Sound and the area between the ODMDS south of Horn Island, and the proposed Biloxi Marsh Complex BU site to the southwest of the project site. The environmental baseline for Gulf sturgeon includes the effects of several activities that may affect the survival and recovery of the threatened Gulf sturgeon in the action area.

5.3.1 Federal Actions

5.3.1.1 Federal Maintenance Dredging

Riverine, estuarine, and coastal navigation channels are often dredged to support commercial shipping and recreational boating. Dredging activities can pose significant impacts to aquatic ecosystems by (1) direct removal/burial of organisms, (2) turbidity/siltation effects,(3) contaminant re-suspension, (4) noise/disturbance, (5) alterations to hydrodynamic regime and physical habitat, and (6) loss of riparian habitat (Chytalo 1996; Winger et al. 2000). Dredging operations may also destroy benthic feeding areas, disrupt spawning migrations, and re-suspend fine sediments causing siltation over required substrate in spawning habitat. Because Gulf sturgeon are benthic omnivores, the modification of the benthos affects the quality, quantity, and availability of prey.

Hydraulic dredges (e.g., hopper) can lethally harm sturgeon directly by entraining sturgeon in dredge drag arms and impeller pumps. Mechanical dredges have also been documented to kill shortnose, Atlantic, and Gulf sturgeon (Dickerson 2005). Dickerson (2013) summarized observed takings of 37 sturgeon from dredging activities conducted by the USACE and observed between October 1990 and January 2013 (3 Gulf; 11 shortnose; and 23 Atlantic). Of the 3 types of dredges included (hopper, clam, and pipeline) in the report, hopper dredges captured the most sturgeon. Notably, reports include only those limited trips when an observer was on board to document capture and does not include sturgeon purposefully removed from the project area prior to dredging activities.

To reduce take of listed species, relocation trawling may be utilized to capture and move sturgeon. In relocation trawling, a boat equipped with nets precedes the dredge to capture sturgeon and then releases the animals out of the dredge pathway, thus avoiding lethal take. Relocation trawling has been successful and routinely moves sturgeon in the Gulf of Mexico. Between January 2005 and April 2006, relocation trawling captured and successfully moved 2 Gulf sturgeon near Mobile Bay, Alabama; 5 near Gulf Shores, Alabama; 1 near Destin, Florida; and 8 near Panama City Beach, Florida. A recent project off Gulf Shores between November 2012 and January 2013 a total of 30 Gulf sturgeon were relocated. Seasonal in-water work periods, when the species is absent from the project area, also assists in reducing incidental take.

In 2003, NMFS completed a Regional Opinion on hopper dredging in the Gulf of Mexico that includes impacts to Gulf sturgeon and its critical habitat via maintenance dredging (NMFS 2003a; NMFS 2005c; NMFS 2007d). NMFS concluded 4 Gulf sturgeon may be killed or injured annually in USACE Gulf of Mexico hopper dredging operations and up to one killed or injured annually during annual relocation trawling in the Gulf of Mexico. Approximately 8 Gulf sturgeon can be nonlethally taken in relocation trawls.

In summary, dredging and disposal to maintain navigation channels, and removal of sediments for beach renourishment occurs frequently and throughout the range of the Gulf sturgeon and within GSCH annually. This activity has, and continues to, threaten the species and affect its designated critical habitat.

5.3.1.2 Fisheries

Federal fisheries in the Gulf of Mexico use a variety of gear types including trawls, gillnet, pelagic and bottom longline, and other types of hook-and-line. Of these gear types, Gulf sturgeon are believed to be susceptible to capture only in trawl and gillnet gear via entanglement. Federal fisheries that NMFS authorizes in the Gulf of Mexico have likely had a minor impact on Gulf sturgeon. This is because Gulf sturgeon occur in the Gulf of Mexico only during winter months and during that time, most migrate alongshore and to barrier island habitats within shallower state waters. A shrimp trawl capture observed on December 15, 2009, was the first and only observed bycatch record in federal waters and was released alive. Prior to the May 2012 shrimp Opinion, Section 7 consultations on federal fisheries have always discounted effects on Gulf sturgeon because of their rarity on federal waters. The new record indicates that past captures in at least trawl gear likely have occurred, but they are still believed to have been rare.

5.3.1.4 Oil and Gas Exploration and Extraction

NMFS has analyzed federal and state oil and gas exploration, production and development, explosive removal of offshore structures, and seismic exploration for potential effects to Gulf sturgeon. Opinions issued by NMFS on August 28, 2006 (NMFS 2006a), July 11, 2002 (NMFS 2002c), November 29, 2002 (NMFS 2002a), August 30, 2003 (Lease Sales 189 and 197 (NMFS 2003b), and June 29, 2007 (2007-2012 5-Year Lease Plan (NMFS 2007a) all concluded that these activities have had no effect on Gulf sturgeon.

5.3.1.5 *Deepwater Horizon* Oil Spill

On April 20, 2010, there was a massive oil spill in the Gulf of Mexico at British Petroleum's DWH well. Million barrels of oil were released into the Gulf, with some experts estimating even higher volumes. The full environmental impact of this disaster will not be known for years to come and may never be known. Assessing the current impacts of this oil spill on Gulf sturgeon and their designated critical habitat is difficult because so much remains unknown or unclear about the impacts to the environment and habitat. Given these uncertainties, it is not practical to speculate on spill effects to the Gulf sturgeon environmental baseline at this time; however, we expect the primary route of effects to designated critical habitat from the release of oil and subsequent cleanup efforts is to the benthos and the benthic community it supports. There are at least 2 routes of exposure: suffocation of infaunal organisms and toxicity of substrate. Both of these effects would impact the abundance of Gulf sturgeon prey. The long-term impact to Gulf sturgeon and their designated critical habitat from exposure to oil and the subsequent response and clean-up efforts is currently unknown.

5.3.1.6 Federally Permitted Discharges

Federally regulated stormwater and industrial discharges and chemically treated discharges from sewage treatment systems may impact Gulf sturgeon and their critical habitat. NMFS continues to consult with EPA to minimize the effects of these activities on both listed species and designated critical habitat. In addition, other federally permitted construction activities, such as beach restoration, have the potential to impact GSCH.

5.3.1.7 ESA Permits

There are no federal permits for Gulf sturgeon research. The states have permitting authority (56 FR 49653 1991; September 30, 1991) and no annual reporting is required.

5.3.2 State or Private Actions

The Gulf sturgeon recovery plan (NMFS and USFWS 1995) documents that Gulf sturgeon are occasionally incidentally captured in state fisheries in bays and sounds along the northern Gulf of Mexico. There is a single recorded interaction (E. Scott-Denton, NOAA, pers. comm. to J. Rueter, NMFS, August 8, 2014) of a Gulf sturgeon with the shrimp trawl fishery: 1 in state waters (December 15, 2009).

In the Pearl River a trammel/gillnet fishery is conducted for gar. Because of the gear (minimum of 3-inch square mesh, up to 3,000 ft in length) and the year-round nature of the fishery, it is probable that Gulf sturgeon are intercepted in this fishery. While state regulations prohibit taking or possession of whole or any body parts, including roe, there is no reporting to determine capture or release rates.

A number of activities that may indirectly affect Gulf sturgeon including discharges from wastewater systems, dredging, ocean pumping and disposal, and aquaculture facilities. The impacts from these activities are difficult to measure. However, where possible, conservation actions through the ESA Section 7 process, ESA Section 10 permitting, and state permitting programs are being implemented to monitor or study impacts from these sources.

Increasing coastal development and ongoing beach erosion will result in increased demands by coastal communities, especially beach resort towns, for periodic privately funded or federally sponsored beach renourishment projects. These activities may affect Gulf sturgeon and their critical habitat by burying nearshore habitats that serve as foraging areas.

5.3.3 Other Potential Sources of Impacts in the Environmental Baseline

5.3.3.1 Marine Pollution and Environmental Contamination

Pollution from industrial, agricultural, and municipal activities is believed responsible for a suite of physical, behavioral, and physiological impacts to sturgeon worldwide (Agusa et al. 2004; Barannikova 1995; Barannikova et al. 1995; Bickham et al. 1998; Billard and Lecointre 2000; Kajiwara 2003; Karpinsky 1992; Khodorevskaya et al. 1997; Khodorevskaya and Krasikov 1999). Although little is known about contaminant effects on Gulf Sturgeon, a review estimating potential reactions has been performed (Berg 2006). It was found that loss of habitat associated with pollution and contamination has been documented for sturgeon species (Barannikova et al. 1995; Shagaeva et al. 1993; Verina and Peseridi 1979). Specific impacts of pollution and contamination on sturgeon have been identified to include muscle atrophy, abnormality of gonad, sperm and egg development, morphogenesis of organs, tumors, and disruption of hormone production (Altuf'yev et al. 1992; Dovel et al. 1992; Georgi 1993; Graham 1981; Heath 1995; Khodorevskaya et al. 1997; Kruse and Scarnecchia 2002; Romanov and Sheveleva 1993).

More recently, pharmaceuticals and other endocrinologically active chemicals have been found in fresh and marine waters at effective concentrations [reviewed in (Fent et al. 2006)]. These compounds enter the aquatic environment via wastewater treatment plants, agricultural facilities, and farm runoff (Culp et al. 2000; Folmar et al. 1996; Wallin et al. 2002; Wildhaber et al. 2000). These products are the source of both natural and synthetic substances including, but not limited to, PCBs, phthalates, pesticides, heavy metals, alkylphenols, polycyclic aromatic hydrocarbons, 17β-estradiol, 17α-ethinylestradiol, and bisphenol A (Aguayo et al. 2004; Björkblom et al. 2009; Iwanowicz et al. 2009; Nakada et al. 2004; Pait and Nelson 2002). The impact of these exposures on Gulf sturgeon is unknown, but other species of fish are affected in rivers and streams. For example, one major class of endocrine disrupting chemicals, estrogenic compounds, have been shown to affect the male to female sex ratio in fish in streams and rivers via decreased gonad development, physical feminization, and sex reversal (Folmar et al. 1996). Settlement of these contaminants to the benthos may affect benthic foragers to a greater extent than pelagic foragers due to foraging strategies (Geldreich and Clarke 1966).

Several characteristics of the Gulf sturgeon (i.e., long lifespan, extended residence in riverine and estuarine habitats, benthic predator) predispose the species to long-term and repeated exposure to environmental contamination and potential bioaccumulation of heavy metals and other toxicants. Chemicals and metals such as chlordane, DDE, DDT, dieldrin, PCBs, cadmium, mercury, and selenium settle to the river bottom and are later incorporated into the food web as they are consumed by benthic feeders, such as sturgeon or macroinvertebrates. Some of these compounds may affect physiological processes and impede the ability of a fish to withstand stress, while simultaneously increasing the stress of the surrounding environment by reducing DO, altering pH, and altering other water quality properties.

While laboratory results are not available for Gulf sturgeon, signs of stress observed in shortnose sturgeon exposed to low DO included reduced swimming and feeding activity coupled with increased ventilation frequency (Campbell and Goodman 2004). Niklitschek (2001) observed that egestion levels for Atlantic and shortnose sturgeon juveniles increased significantly under hypoxia, indicating that consumed food was incompletely digested. Behavioral studies indicate that Atlantic and shortnose sturgeon are quite sensitive to ambient conditions of oxygen and temperature: in choice experiments juvenile sturgeons consistently selected normoxic (normal oxygen level) over hypoxic (low oxygen level) conditions (Niklitschek 2001). Beyond escape or avoidance, sturgeons respond to hypoxia through increased ventilation, increased surfacing (to ventilate relatively oxygen-rich surficial water), and decreased swimming and routine metabolism (Crocker and Cech Jr. 1997; Niklitschek 2001; Nonnotte et al. 1993; Secor and Gunderson 1998).

The majority of published data regarding contaminants and sturgeon health are limited to reports of tissue concentration levels. While these data are useful and allow for comparison between individuals, species, and regions, they do not allow researchers to understand the impacts of the concentrations. There is expectation that Gulf sturgeon are being negatively impacted by organic and inorganic pollutants given high concentration levels (Berg 2006). Gulf sturgeon collected from a number of rivers between 1985 and 1991 were analyzed for pesticides and heavy metals (Bateman et al. 1994); concentrations of arsenic, mercury, DDT metabolites, toxaphene, polycyclic aromatic hydrocarbons, and aliphatic hydrocarbons were sufficiently high to warrant concern. More recently, 20 juvenile Gulf sturgeon from the Suwannee River, Florida, exhibited an increase in metals concentrations with an increase in individual length (Alam et al. 2000).

Federal and state water quality standards are protective of most taxa in many habitats. However, impacts of reduced water quality continue to be realized at species-specific and habitat-specific scales, and magnification through the trophic levels continues to be assessed. The effects of most of these chemicals on the Gulf sturgeon or other protected species are poorly understood. Also, because there are thousands of chemicals interacting in our natural environment, many of them of human design, many do not have federal or state water quality standards associated with them.

5.3.4 Conservation and Recovery Actions Benefiting Gulf Sturgeon

5.3.4.1 Cooperation with the States

Man-made marine debris, pollution, runoff, and nutrient loading, stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. Coupled with atmospheric loading of pollutants such as PCBs, these impacts are difficult to measure. Where possible, conservation actions are being implemented to monitor or study impacts from these sources. For example, the State of Florida recently required the USACE to conduct pre- and post-construction prey surveys as part of a permit to remove sand for a beach renourishment project. NMFS is working with Florida to ensure that data and results will be useful in determining project impacts.

Cooperative conservation partnerships between NMFS and states can be formalized by entering into agreements pursuant to Section 6 of the ESA. NMFS has established partnerships for cooperative research on Gulf sturgeon via conservation agreements in the Gulf of Mexico with the States of Florida, Alabama, Mississippi, and Louisiana. Prior to issuance of these agreements, the proposal must be reviewed for compliance with Section 7 of the ESA.

Implementation of the Florida Net Ban (Amendment 3 of the Florida Constitution) in 1995 has likely benefited sturgeon. The Net Ban made unlawful the use of entangling nets (i.e., gill and trammel nets) in Florida waters and likely benefitted or accelerated Gulf sturgeon recovery given residence of sturgeon in near-shore waters where tangling gear is commonly used during much of their life span. Capture of small Gulf sturgeon in mullet gill nets was documented by state fisheries biologists in the Suwannee River fishery in the early 1970s. Large mesh gill nets and runaround gill nets were the fisheries gear of choice in historic Gulf sturgeon commercial fisheries. Absence of this gear in Florida eliminates it as a potential source of mortality of Gulf sturgeon.

5.3.4.2 Use of Turtle Excluder Devices in Trawl Fisheries

Gulf sturgeon benefit from the use of devices inserted into trawl nets designed to exclude other species, such as sea turtles and fish. Evidence of exclusion from a shrimp trawl net was documented when an Atlantic sturgeon caught off South Carolina by a shrimp trawler in December 2011 exited the through the TED alive. TEDs and bycatch reduction device requirements are expected to reduce bycatch of the conspecific (organism belonging to the same species) Atlantic sturgeon in Southeast trawl fisheries (ASSRT 2007). NMFS has required the use of TEDs in some Gulf of Mexico shrimp trawls since 1989 and the regulations have been refined over the years to ensure effectiveness is maximized through more widespread use, and proper placement, installation, configuration (e.g., width of bar spacing), and floatation.

5.3.4.3 Gulf Sturgeon Sampling Protocol

NMFS and USFWS established a standardized sampling protocol with the Gulf sturgeon researchers in 2010. Procedures for tagging were established, PIT tag frequencies were standardized, and a common datasheet was established. Tag information and morphometric data are being stored in a shared database managed by NMFS. A similar workshop to discuss and establish monitoring protocols occurred in 2012.

5.3.4.4 Other Actions

In 2009, NMFS and USFWS completed a 5-year status review for Gulf sturgeon (USFWS and NMFS 2009) and concluded that the species continues to meet the status of a threatened species. As part of that review, NMFS and USFWS also critiqued the recovery criteria listed in the 1995 Recovery Plan (USFWS and GSMFC 1995) and concluded that new criteria are necessary to (1) reflect the best available and most up-to date information on the biology of the species, (2) address the 5 statutory listing/recovery factors, and (3) improve monitoring methods for demonstrating progress towards reducing threats and for determining when the protections of the Act are no longer necessary. NMFS and USFWS are actively working to revise and update the 1995 Gulf Sturgeon Recovery Plan.

5.3.5 Summary and Synthesis of Environmental Baseline for Gulf sturgeon

In summary, few factors adversely affect Gulf sturgeon in the Gulf of Mexico although these factors are ongoing and are expected to occur simultaneously with the proposed action. Gulf sturgeon will be taken annually through activities to maintain federal channels and sand mining for beach renourishment. Point and non-point runoff will continue to have adverse effects on estuarine and marine habitats. The recent DWH oil spill event is expected to have had an adverse impact on the baseline for GSCH, but the extent of that impact is not yet well understood. Actions to conserve and recover Gulf sturgeon have significantly increased over the past 10 years and are expected to continue.

5.4 Status of Gulf Sturgeon Critical Habitat within the Action Area

The status of GSCH in the action area, as well as the threats to this critical habitat, are supported by the critical habitat account in Section 4.8 (Status of the Critical Habitat).

5.5 Factors Affecting Gulf Sturgeon Critical Habitat Critical Habitat within the Action Area

The April 2003 joint designation of GSCH by NMFS and USFWS will benefit the species primarily through the ESA Section 7 consultation processes. When critical habitat is designated, other federal agencies are required to consult with NMFS on actions they carry out, fund, or authorize, to ensure that their actions will not destroy or adversely modify critical habitat. In this way, a critical habitat designation will protect physical and biological features that are essential to the conservation of the species. Designation of critical habitat may also enhance awareness within federal agencies and the general public of the importance of GSCH and the need for special management considerations. Further, federal Essential Fish Habitat (EFH) consultation requirements pursuant to the Magnuson-Stevens Fishery Management and Conservation Act may minimize and mitigate for losses of wetlands and preserve valuable GSCH. Since designation, over 71,640 acres have been impacted (temporarily and permanently) in Unit 8 from NMFS-consulted actions.

DWH Legacy Effects on *Gulf Sturgeon Critical Habitat*
According to an analysis conducted by NMFS on the DWH spill oiling legacy (M. Press, NMFS, memo to D. Bernhart, NMFS, December 8, 2014), indirect impacts to water quality could occur

if the authorized activities disturbed a submerged oil mats (SOMs) remnant of the DWH spill. Contributors to Operational Science Advisory Team (OSAT III) report have stated that while there is a possibility that dredging activities could re-suspend oil into the water column in certain areas, the likelihood of this happening is low. Additionally, an analysis of the matrix of material (oil plus sand) stranded in mats revealed that SOMs were composed mostly of sand: 83.2%-90.6% sand and 9.4%-16.8% oil (OSAT II). Furthermore, the likelihood of any re-suspended DWH oil being toxic is low, and should not have measurable effects on water quality (or on listed species directly) (W. Bryant, OSAT III Science Team Lead, pers. comm. to M. Press, NMFS, July 31, 2014).

Indirect impacts to sediment quality could occur if the authorized activities disturbed a SOM as described above, and release chemical pollutants into sediments. Based on information presented in OSAT II and III, NMFS believes that the likelihood of encountering a SOM during the dredging activity in this area is extremely low. Furthermore, if a SOM is disturbed and oil is suspended into the water column or mixed into the sediment, NMFS believes that the toxicity levels would be minimal and would dissipate quickly. Therefore, NMFS concludes the proposed effects on the sediment quality essential feature will be insignificant.

Direct effects to prey abundance could occur if the authorized activities expose aquatic invertebrates to chemical pollutants emanating from disturbed SOMs. However, OSAT II reports that concentrations of oil constituents in the aquatic environment are predicted to drop off exponentially within millimeters (mm) from the micro-layer around SOMs, as a result of mixing. Given this and the fact that the likelihood of SOMs being disturbed is very low, NMFS concludes that effects on the Gulf sturgeon prey abundance will be insignificant.

6 EFFECTS OF THE ACTION

Effects of the action include direct and indirect effects of the action under consultation. Indirect effects are those that result from the proposed action, occur later in time (i.e., after the proposed action is complete), but are still reasonably certain to occur. Effects of the proposed action also include effects of other activities that are interrelated or interdependent with the proposed action. Interrelated actions are those that are part of a larger action and depend on that larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. At this time, NMFS does not foresee any interrelated or interdependent effects.

Activities Likely to Adversely Affect Listed Species
Potential routes of effects of the proposed action on sea turtles and Gulf sturgeon include direct and indirect effects of the proposed action attributable to hopper dredging and relocation trawling, which will be discussed below.

6.1 Effects to Sea Turtles

We first review the range of responses an individual sea turtle may have when exposed to different aspects of the proposed action, and then the factors affecting the likelihood, frequency, and severity of sea turtle exposure. Effects are generally broken down into 3 categories: interactions, captures, and mortalities. An interaction occurs anytime sea turtles come into contact with hopper dredges or relocation trawls. Finally, we discriminate between lethal and nonlethal effects for the various components of the proposed action where applicable.

6.1.1 Hopper Dredge

It has been previously documented in NMFS Biological Opinions that hopper dredges have captured, injured, and killed sea turtles. Hopper dredges move relatively rapidly (compared to sea turtle swimming speeds) and can entrain and kill sea turtles as the drag arm(s) of the moving dredge overtakes the slower moving or stationary sea turtle. In U.S. waters, loggerhead, hawksbill, Kemp's ridley, and green sea turtles are vulnerable to entrainment in the suction draghead of the hopper dredge. These sea turtle species are likely to be feeding on or near the bottom of the water column during the warmer months, with loggerhead and Kemp's ridley sea turtles being the most common species in this area of the Gulf, however, green sea turtles are also likely to occur within this area. Leatherback sea turtles are generally not vulnerable to entrainment due to their large size and generally pelagic habits. Furthermore, the USACE has no records of leatherback sea turtles being entrained in hopper dredge operations within the Gulf of Mexico or elsewhere.[9,10]

Sea turtles can become entrained in hopper dredges as the draghead moves along the bottom. Entrainment occurs when sea turtles cannot escape from the suction of the dredge. Sea turtles can also be crushed on the bottom by the moving draghead. Mortality most often occurs when turtles are sucked into the dredge draghead, pumped through the intake pipe, and then killed as they cycle through the centrifugal pump and into the hopper. Because entrainment is believed to occur primarily while the draghead is operating on the bottom, it is likely that only those species feeding or resting on or near the bottom would be vulnerable to entrainment. Turtles can also be entrained if suction is created in the draghead by current flow while the device is being placed or removed, or if the dredge is operating on an uneven or rocky substrate and rises off the bottom. Reports based on dredge take during USACE navigation channel maintenance projects suggests that the risk of entrainment is highest when the bottom terrain is uneven or when the dredge is conducting "cleanup" operations at the end of a dredge cycle when the bottom is trenched and the dredge is working to level out the bottom. In these instances, it is difficult for the dredge operator to keep the draghead buried in the sand, thus sea turtles near the bottom may be more vulnerable to entrainment. Sea turtles have been found resting in deeper waters, which could increase the likelihood of interactions from dredging activities conducted there.

6.1.1.1 Hopper Dredge Impingement/Entrainment

Dredged material is raised by dredge pumps through dragarms connected to drags in contact with the channel bottom and discharged into hoppers built in the vessel. Hopper dredges are equipped with large centrifugal pumps similar to those employed by other hydraulic dredges. Suction pipes (dragarms) are hinged on each side of the vessel with the intake (drag) extending downward toward the stern of the vessel. The dragarm is moved along the bottom as the vessel

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[9] USACE. 2013. USACE Sea Turtle Data Warehouse - South Atlantic Division. http://el.erdc.usace.army.mil/seaturtles/info.cfm?Type=Division&Code=SAD. Accessed 7/18/2016.

[10] USACE. 2016. Operations and Dredging Endangered Species System. http://dqm.usace.army.mil/odess/#/home. Accessed 7/18/2016.

moves forward at speeds up to 3-5 miles per hour (mph). The dredged material is sucked up the pipe and deposited and stored in the hoppers of the vessel.

Most sea turtles are able to escape from the oncoming draghead due to the slow speed that the draghead advances (up to 3 mph or 4.4 ft/second). Interactions with a hopper dredge result primarily from crushing when the draghead is placed on the bottom or when an animal is unable to escape from the suction of the dredge and becomes stuck on the draghead (impingement). Entrainment occurs when organisms are sucked through the draghead into the hopper. Mortality most often occurs when animals are sucked into the dredge draghead, pumped through the intake pipe and then killed as they cycle through the centrifugal pump and into the hopper.

Interactions with the draghead can also occur if the suction is turned on while the draghead is in the water column (i.e., not seated on the bottom). USACE implements procedures to minimize the operation of suction when the draghead is not properly seated on the bottom sediments which reduce the risk of these types of interactions.

Sea turtles have been killed in hopper dredge operations along the South Atlantic and Gulf coasts of the United States. Turtle mortalities documented during dredging operations in the USACE South Atlantic Division (SAD), which includes North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Puerto Rico, and the U.S. Virgin Islands, are more common in the South Atlantic presumably due to the greater abundance of turtles in these waters and the greater frequency of hopper dredge operations. On the South Atlantic coast (North Carolina, South Carolina, Georgia, Florida), approximately 624 sea turtles have been entrained in hopper dredges since 1980 and in the Gulf Region (Texas, Louisiana, Mississippi, Alabama, and Florida) approximately 220 sea turtles have been killed since 1995 (Tables 12 and 13).

Table 12. Gulf Region Documented Dredging Turtles Takes (including New Orleans, Mobile, Jacksonville, and Galveston districts) 1995-2015

Loggerhead	Kemps	Green	Leatherback	Hawksbill	Unknown	Total	Number of projects
123	52	42	0	0	3	220	223

Table 13. South Atlantic Region Documented Dredging Turtle Takes (including Jacksonville, Savannah, Charleston, and Wilmington) 1980-2015

Loggerhead	Kemps	Green	Leatherback	Hawksbill	Unknown	Total	Number of projects
420	34	80	0	0	90	624	298

Interactions are likely to be most numerous in areas where sea turtles are resting or foraging on the bottom. When sea turtles are at the surface or within the water column, they are not likely to interact with the dredge because there is little, if any, suction force in the water column. Sea turtles have been found resting in deeper waters, which could increase the likelihood of interactions from dredging activities. In 1981, observers documented the take of 71 loggerheads by a hopper dredge at the Port Canaveral Ship Channel, Florida (Slay and Richardson 1988).

This channel is a deep, low-productivity environment in the Southeast Atlantic where sea turtles are known to rest on the bottom, making them extremely vulnerable to entrainment. The large number of turtle mortalities at the Port Canaveral Ship Channel in the early 1980s resulted in part from turtles' being buried in the soft bottom mud, a behavior known as brumation. Chelonid turtles have been found to make use of deeper, less productive channels as resting areas that afford protection from predators because of the low energy, deep water conditions. Habitat in the action area is not consistent with areas where sea turtle brumation has been documented; therefore, we do not anticipate any sea turtle brumation in the action area.

In the 2003 GRBO (NMFS 2003a), NMFS acknowledges that documented takes represent partial estimates of total takes and believes that some takes may pass undetected by observers through inflow screening devices, due to the force of the water pressure, or because the animals are killed but not entrained; NMFS-approved observers monitor dredged material inflow and overflow screening baskets on many projects; however, screening is only partially effective and observed, documented takes provide only partial estimates of total sea turtle mortality.

It is NMFS's opinion that some listed species taken by hopper dredges go undetected because body parts are forced through the sampling screens by the water pressure and are buried in the dredged material, or animals are crushed or killed but not entrained by the suction and so the takes may go unnoticed. The only mortalities that are documented are those where body parts either float, or are large enough to be caught in the screens, and can be identified as from sea turtle species. NMFS estimates that unseen (thus, undocumented) takes represent roughly 50% of total documented takes and has evaluated the effects of the action including the expected undocumented takes.

6.1.1.2 Lethal Takes by Hopper Dredge

We analyzed the number of turtles killed by hopper dredging in previous hopper dredge projects in the Mobile District to estimate take from the proposed action. The USACE has posted reported sea turtle takes from hopper dredging activities for operations for the Mobile District between 2002 and 2015. [11,12] For the recorded activity between 2002 and 2015 within the Mobile District, there have been over 56 projects that have required a hopper dredge. During that 14-year time period, the project site-specific available data on sea turtle interactions with hopper dredges shows that 19 sea turtles (12 Kemp's ridley, 6 loggerhead, 1 green) have been documented as killed by hopper dredging activities. In addition to these 19 lethal sea turtle interactions by hopper dredge, pre-dredge and project-required relocation trawling for hopper dredge projects for the Mobile District over the past 10 years (2006 - 2015) resulted in the following total numbers of turtles relocated: 253 Kemp's ridleys, 163 loggerheads, 8 greens, and 4 leatherbacks. While this information demonstrates that Kemp's ridley, loggerhead, green, and leatherback sea turtles are known to occur in the action area, it does not provide quantitative information on status, trends, or density of these species in the action area. However, it does help us anticipate which species are likely to be within the action area in the absence of specific population data (e.g., nesting, migration).

[11] USACE. 2013. USACE Sea Turtle Data Warehouse - South Atlantic Division. http://el.erdc.usace.army.mil/seaturtles/info.cfm?Type=Division&Code=SAD. Accessed 7/18/2016.

[12] USACE. 2016. Operations and Dredging Endangered Species System. http://dqm.usace.army.mil/odess/#/home. Accessed 7/18/2016.

Table 14. Gulf Region Relocation Trawl Turtles Takes (2006-2015)

Fiscal Year	Days of trawling	Loggerhead	Kemps	Green	Leatherback	Hawksbill	Total	Numbers of projects
2006	269	62	41	4	2	0	109	3
2007	28	1	2	0	1	0	4	3
2008	0	0	0	0	0	0	0	0
2009	149	29	9	0	0	0	38	4
2010	56	2	2	0	0	0	4	2
2011	418	20	72	1	0	0	93	2
2012	73	5	3	0	0	0	8	1
2013	224	33	66	3	1	0	103	2
2014	0	0	0	0	0	0	0	0
2015	303	11	58	0	0	0	69	4
Total	1520	163	253	8	4	0	428	21
Probability of capture per trawl		0.381	0.591	0.019	0.009	0.000	1.000	

The above data shown in Tables 12 and 14 indicates that Kemp's ridley sea turtles have been the predominant species for both hopper dredge and relocation trawl captures, followed by loggerhead, green, and leatherback sea turtles. We will use the USACE Mobile District data for relocation trawling (Table 14) in this analysis since it is the larger of the 2 data sets in terms of sea turtle captures. Specifically, USACE Mobile District relocation trawling nonlethal take data show that 59% of takes were Kemp's ridley, 38% were loggerhead, and 1.9% were green sea turtles. While the relocation trawling data also shows that 0.9% of captures were leatherback turtles, no entrainment of leatherbacks by hopper dredge have been documented in the Gulf of Mexico or elsewhere, so no lethal take of leatherbacks due to hopper dredging will be authorized in this Opinion. Because of the location of the dredge site where hopper dredging and relocation trawling will occur and the location of the potential disposal areas, NMFS believes Kemp's ridleys are more likely to be in the action area, and in greater abundance, than either loggerheads or green sea turtles and we expect that Kemp's ridleys will be encountered by hopper dredges more than the other 2 species.

To estimate the number of sea turtles that may be killed by the proposed action, we examined the ratio of sea turtles killed to the total number of cubic yards hopper dredged, as we have in past Opinions on similar actions. The total cubic yards of material dredged for the entire Mobile District for the 14-year time period (2002 – 2015) is 67,431,008 yd^3. The number of sea turtles that were documented by onboard observers as killed by hopper dredging in association with these projects totaled 19 sea turtles (12 Kemp's, 6 loggerhead, 1 green). If we divide the total cubic yards dredged (67,431,008) by the total number of sea turtles observed as killed by hopper dredge (19), this equals 1 *observed* sea turtle mortality for every 3,549,000 yd^3 dredged. The proposed action could dredge approximately 7,673,000 yd^3 of material from the proposed expansion areas (Table 2). Based on the calculations above (7,673,000/3,549,000 = 2.16), we might estimate that 2.16 sea turtles would be observed as killed by the proposed action. Due to the encounter data discussed above, we believe that 1.27 Kemp's ridleys (2.16 x .59=1.27), 0.82 loggerhead (2.16 x .38=0.82); and 0.04 green turtles (2.16 x 0.019=0.04) may be observed to be lethally taken by hopper dredging per fiscal year.

The number of captures in any given year can be based on reporting (as discussed above) and can also be influenced by sea temperatures, species abundances in a given year, fluctuating salinity levels, and other factors that cannot be predicted. For these reasons, we believe basing our future incidental take estimate on a 1-year estimated take level is largely impractical. For these reasons, and based on our experience monitoring other dredging activities, we believe a 3-year time period is appropriate for meaningful monitoring. The triennial takes are set as 3-year running sums (total for any consecutive 3-year period) and not for static 3-year periods (i.e., 2015-2017, 2016-2018, 2017-2019 and so on, as opposed to 2017-2019, 2020-2022). This approach reduces the likelihood reinitiation of ESA consultation will be required unnecessarily because of inherent variability in take levels, while still allowing for an accurate assessment of how the proposed actions are performing versus our expectations. Thus, the total anticipated observed lethal take of sea turtles by hopper dredging for any 3-year time period is 3.81 Kemp's ridley (1.27 x 3=3.81), 2.46 loggerhead (0.82 x 3=2.46), and 0.12 green turtles (0.04 x 3=0.12). Because partial turtles cannot be taken, the observed lethal take values are rounded up to 4 Kemp's ridley, 3 loggerhead, and 1 green sea turtle per consecutive 3-year period.

As discussed above, dredged material screening by observers on hopper dredges is only partially effective, and observed interactions are expected to document only 50% of sea turtles entrained and killed by a hopper dredge (NMFS 2003a). Thus, the anticipated total lethal take of sea turtles per consecutive 3-year period (observed and unobserved) by the proposed action's hopper dredging is 8 Kemp's ridley (4 x 2=8), 6 loggerhead (3 x 2=6), and 2 green sea turtles (1 x 2=2).

6.1.2 Relocation Trawling

Relocation trawling, when it can be done safely, is a means to reduce sea turtle mortalities because it is a proven method of reducing sea turtle density in front of an advancing hopper dredge and very likely results in reduced sea turtle/hopper dredge interactions. Nets are dragged on the sea bottom for 30 minutes or less before each retrieval and re-setting. Their effects are mostly nonlethal and non-injurious to trawl-captured sea turtles. Over the course of 20+ years that relocation trawling has been conducted by the USACE, very few sea turtle mortalities (approximately 8, of which 3 died under unusual circumstances [NMFS post-mortems determined the turtles drowned] during intensive relocation trawling efforts associated with the DWH event and subsequent emergency oil barrier sand berm construction) have occurred, while approximately 2,000 sea turtles have been safely relocated.

6.1.2.1 Nonlethal Take by Relocation Trawling

Calculation of Sea Turtle Relocation Rates during Hopper Dredging

To calculate the number of each species of turtle expected to be relocated, we consulted the USACE Sea Turtle Data Warehouse and the Operations and Dredging Endangered Species System (ODESS) for the number of turtles captured from 2006-2015 in relocation trawls and the corresponding number of days of relocation trawling for each year. This was necessary to find the most applicable historic relocation trawling information for the project area. This data is summarized for both sea turtles and Gulf sturgeon in Table 15 below. A total of 428 sea turtles and 45 Gulf sturgeon were safely trawl-captured and released over 1,520 days of relocation trawling during fiscal years 2006-2015.

The probability for future capture is calculated based on the combined number of captures (sea turtle and sturgeon). This averages out to be approximately 0.311 (473 ÷ 1,520 = 0.311) listed species captured per relocation trawling day. Estimating the expected number of trawl-captured turtles during this project is difficult and necessarily imprecise because of the uncertainties associated with the project, the various seasons, varying water temperatures, differences in availability and location of sea turtle potential foraging habitat from year to year (which may cause turtles to move into or out of the action area), and different bottom substrates (sand and mud to hard clay) and topography (smooth vs. rough and undulating) over which the trawling may be performed (which affects capture trawling effectiveness). On average, 0.311 sea turtles and Gulf sturgeon were captured per day of relocation trawling. Relocation trawling for the Port of Gulfport Expansion Project will only occur during hopper dredging which will take 3 months (~ 90 days) each fiscal year.

Table 15. Sea Turtle/Gulf sturgeon Relocation Trawling Efforts in Mobile District, 2006-2015

Fiscal Year	Days of Trawling	Loggerhead	Kemp's ridley	Green	Leatherback	Hawksbill	Gulf Sturgeon	Total Relocated Species
2006	269	62	41	4	2	0	13	122
2007	28	1	2	0	1	0	0	4
2008	0	0	0	0	0	0	0	0
2009	149	29	9	0	0	0	0	38
2010	56	2	2	0	0	0	0	4
2011	418	20	72	1	0	0	0	93
2012	73	5	3	0	0	0	0	8
2013	224	33	66	3	1	0	32	135
2014	0	0	0	0	0	0	0	0
2015	303	11	58	0	0	0	0	69
		Sum of Individual Relocated Species						
Total Mobile District Relocation Trawling Days	**1520**	**163**	**253**	**8**	**4**	**0**	**45**	**473**
Species Percentage		34%	53%	2%	1%	0%	10%	100%
Total Turtles Relocated	**428**							
Listed Species per day	**0.311**							

To determine the number of each species of turtle expected to be relocated, we multiplied the species per day from Table 15 (0.311) times the number of possible relocation trawling days (90), which gives us the total anticipated amount of species to be captured by relocation trawl during a fiscal year (0.311 x 90 = 27.99). We then calculate the species percentage of capture for previous relocation trawling efforts in the area from Table 15. This is calculated by dividing the sum of the captured turtle species by the total of all listed species captured [53% Kemp's ridley, (253 ÷ 473= 0.535); 34% loggerhead, (163 ÷ 473 = 0.345); 2% green, (8 ÷ 473 = 0.017); and 1% for leatherback, (4 ÷ 473 = 0.008)] to determine the quantity and species composition of the expected relocated sea turtles (Table 16). As calculated above, we expect 27.99 sea turtles and Gulf sturgeon to be captured via relocation trawl. When we apply the above species percentages, we end up with 14.97 Kemp's ridley, 9.66 loggerhead, 0.48 green; and 0.22 leatherback sea turtles; —a total of 25.34 sea turtles relocated during the expected 90 days of relocation trawling in a single fiscal year.

Table 16. Sea Turtle/Gulf sturgeon Relocation Trawling Species Composition

Trawling days: 90	Loggerhead	Kemp's ridley	Green	Leatherback	Hawksbill	Gulf Sturgeon	Total Turtles Relocated	Total Relocated
Species Percentage	34%	53%	2%	1%	0%	10%	-	100%
Turtles relocated	9.66	14.97	0.48	0.22	0.000	2.66	25.34	27.99

The effects of capture and handling during relocation trawling can result in raised levels of stressor hormones and can cause some discomfort during tagging procedures. Based on past observations obtained during similar research-trawling for turtles, these effects are expected to dissipate within a day (Stabenau and Vietti 2003). Since turtle recaptures are not common, and recaptures that do occur typically happen several days to weeks after initial capture, cumulative adverse effects of recapture are not expected. The reasoning behind this is turtles that are nonlethally taken by a closed net trawl, which is observing trawl speed and tow-time limits, will be safely relocated to an area outside of the trawl area (typically 3-5 miles). If the turtle is to be captured again, the turtle will have had ample time to recover from the stress of the experience of the trawl net.

Relocation trawling will be undertaken by the USACE and/or the applicant where any of the following conditions are met: (a) 2 or more turtles are taken by hopper dredges in a 24-hour period during the project; or (b) total hopper dredge takes in the project approach 75% (rounded-down) of any of the incidental take limits (Table 20). Handling of sea turtles captured during relocation trawling in association with hopper dredging shall be conducted by NMFS-approved endangered species observers.

The number of relocation trawling captures in any given year can be based on reporting (as discussed above) and can also be influenced by sea temperatures, species abundances in a given year, fluctuating salinity levels, and other factors that cannot be predicted. For these reasons, we believe basing our future incidental take estimate on a 1-year estimated nonlethal take level is largely impractical. For these reasons, and based on our experience monitoring other relocation trawling activities, we believe a 3-year time period is appropriate for meaningful monitoring. The triennial takes are set as 3-year running sums (total for any consecutive 3-year period) and not for static 3-year periods (i.e., 2015-2017, 2016-2018, 2017-2019 and so on, as opposed to 2017-2019, 2020-2022). This approach reduces the likelihood reinitiation of ESA consultation will be required unnecessarily because of inherent variability in nonlethal take levels, while still allowing for an accurate assessment of how the proposed actions are performing versus our expectations. Thus, the total anticipated nonlethal take of sea turtles by relocation trawling for any consecutive 3-year time period is 44.91 Kemp's ridley (14.97 x 3 =44.91), 28.98 loggerhead (9.66 x 3=28.98), 1.44 green (0.48 x 3=1.44); and 0.66 leatherback sea turtles (0.22 x 3=0.66). Because partial turtles cannot be taken, the nonlethal take values are rounded up to 45 Kemp's ridley, 29 loggerhead, 2 green, and 1 leatherback sea turtle per consecutive 3-year period.

6.1.2.2 Lethal Take by Relocation Trawl

NMFS believes there is a remote possibility that the proposed relocation trawling could injure or kill sea turtles that may already have impaired health. Stressed or unhealthy turtles or turtles exposed to repeated forced submergences are more likely to be injured or killed during relocation trawling than healthy turtles. Mortality associated with relocation trawling is primarily due to turtles being previously stressed or diseased, or being struck by trawl doors or accidents on deck when brought on board. NMFS estimates that for this action, sea turtle trawling and relocation efforts will result in lethal take. Because the risk of injury and death does exist, it will also be necessary to authorize potential lethal interactions associated with relocation trawling. Although there has not been any lethal take via relocation trawls in the Mobile District during the 2006-2015 time period, lethal take has occurred in other USACE Districts in the Gulf of Mexico.

Over the course of the last 20+ years that relocation trawling has been conducted by the USACE in the Gulf of Mexico, very few sea turtle mortalities (approximately 8, of which 3 died under unusual circumstances and apparently drowned during intensive relocation trawling efforts associated with the DWH event) have occurred, while approximately 2,000 sea turtles have been safely relocated. Based on USACE relocation trawling take reports from the Gulfport/Mississippi Sound area (1986-2015), NMFS estimates that the risk of a sea turtle being killed in a capture trawl net is less than 0.4%. While NMFS believes that it is unlikely that a sea turtle will be killed or injured during capture trawling (using modified shrimp trawl nets), the possibility of lethal take is still present. Given that our estimate of nonlethal take is 77 sea turtles captured by relocation trawling during consecutive 3-year periods; multiplying 77 by the estimated 0.4% mortality would equal 0.308 ≈ 1 sea turtle killed (77 x 0.004 = 0.308 ≈ 1). NMFS conservatively estimates 1 sea turtle lethal take by relocation trawl during consecutive 3-year periods. NMFS believes that the single turtle mortality will most likely be a Kemp's ridley, but it may also consist of either a loggerhead or green sea turtle. This estimate of 1 lethal take by relocation trawling is not in addition to the estimates provided above; rather, it is part of the total estimated takes by relocation trawling. This take level represents a total take per consecutive 3-year period for all relocation trawling involved with this project (initial dredging and future maintenance dredging).

6.2 Effects to Gulf Sturgeon

As explained in the project description, dredging will be conducted in the Port of Gulfport project area. Below, the discussion will consider the effects of hopper dredging, including the risk of entrainment or capture of Gulf sturgeon. Last, we discuss relocation trawling effects.

6.2.1 Hopper Dredging

Dredge entrainment of Gulf sturgeon by hopper dredging has previously been assessed by NMFS in many Section 7 consultations. NMFS determined that the hopper dredge projects may adversely affect the species, but would not jeopardize the species existence given either the projects' limited scope and/or the seasonal presence of Gulf sturgeon. The USACE SAD reports that from 1990-2015, 37 interactions with sturgeon (Atlantic, shortnose, and Gulf) occurred during dredge operations division wide. Of these, 3 were reported as Gulf sturgeon, all of which were entrained in hopper dredges (December 13 and 28, 2004, and January 5, 2005) during the Gulfport Harbor and Mobile Bar Channel dredging (Table 17). All of these interactions occurred in the Mobile District.

Several factors are thought to contribute to the likelihood of entrainment. The hopper dredge draghead operates on the bottom and is typically at least partially buried in the sediment. Sturgeon are benthic feeders and are often found at or near the bottom while foraging. Gulf sturgeon are more likely to be present in estuarine and coastal waters, and passes between the barrier islands, during winter-time dredging. Gulf sturgeon may be more sensitive to vibrations transmitted along the bottom (by a noisy, approaching hopper dredge draghead) than other fishes due to their physostomus (a pneumatic duct that connects gas bladder and gut to allow gas to be taken in and emitted) swim bladder. Gulf sturgeon are known to rest and forage for long periods along the marine bottom, but they are mobile and are not likely to be entrained, even by a rapidly approaching (approximately 3-5 knots) hopper dredge deflector draghead.

Table 17. USACE SAD Gulf Sturgeon Entrainment Records from Hopper Dredge Operations 1990-2015

Project Location	Corps Division/District	Take Date	Project Yardage Removed	Observed Entrainment
‡ Gulfport Harbor Channel	Mobile District	December 13, 2004	No Data	1
‡ Mobile Bar Channel	Mobile District	December 28, 2004; January 1, 2005	3,231,166 yd^3	2

‡ Records based on sea turtle observer reports which record listed species entrained as well as all other organisms entrained during dredge operations.

In the 2003 GRBO (NMFS 2003a), NMFS acknowledges that documented takes represent partial estimates of total takes and believes that some takes may pass undetected by observers through inflow screening devices, due to the force of the water pressure, or because the animals are killed but not entrained. NMFS-approved observers monitor dredged material inflow and overflow screening baskets on many projects; however, screening is only partially effective and observed, documented takes provide only partial estimates of total Gulf sturgeon mortality.

It is NMFS's Opinion that some listed species taken by hopper dredges go undetected because body parts are forced through the sampling screens by the water pressure and are buried in the dredged material, or animals are crushed or killed but not entrained by the suction and so the takes may go unnoticed. The only mortalities that are documented are those where body parts either float, or are large enough to be caught in the screens, and can be identified as sturgeon species. NMFS estimates that unseen (thus, undocumented) takes represent roughly 50% of total documented takes and has evaluated the effects of the action including the expected undocumented takes.

6.2.1.1 Lethal Takes by Hopper Dredge

Because observers have been present on the hopper dredges in the Mobile District, we expect that any observed interactions with Gulf sturgeon would have been reported to NMFS. The interaction rate between hopper dredges and Gulf sturgeon is documented to be low, even just considering the projects listed in Table 17, where entrainment was recorded. From 2002 to 2015, the Mobile District has had 60 projects with cubic yardage calculations totaling 67,431,008 yd^3. During this time period, 3 Gulf sturgeon were reported taken. If we calculate the amount of cubic yardage dredged per the amount of sturgeon entrained, we would expect approximately 1 Gulf sturgeon for approximately every 22,477,002 yd^3 of material removed (67,431,008 yd^3 ÷ 3 Gulf sturgeon = 22,477,002 yd^3). Given that the project anticipates the removal of 7,673,000 yd^3 of material from the proposed expansion areas (Table 2), the expected entrainment is approximately 0.34 sturgeon (7,673,000 yd^3 ÷ 22,477,002 yd^3 = 0.34). Based on the calculations above, we would estimate that 0.34 Gulf sturgeon would be observed as killed by the proposed action's hopper dredging per fiscal year.

The number of captures in any given year can be based on reporting (as discussed above) and can also be influenced by sea temperatures, species abundances in a given year, fluctuating salinity levels, and other factors that cannot be predicted. For these reasons, we believe basing our future incidental take estimate on a 1-year estimated take level is largely impractical. For these reasons, and based on our experience monitoring other dredging activities, we believe a 3-year time period is appropriate for meaningful monitoring. The triennial takes are set as 3-year running sums (total for any consecutive 3-year period) and not for static 3-year periods (i.e., 2015-2017, 2016-2018, 2017-2019 and so on, as opposed to 2017-2019, 2020-2022). This approach reduces the likelihood reinitiation of ESA consultation will be required unnecessarily because of inherent variability in take levels, while still allowing for an accurate assessment of how the proposed actions are performing versus our expectations. Thus, the total anticipated observed lethal take of Gulf sturgeon by the hopper dredging for any consecutive 3-year time period is 1.02 individuals (0.34 x 3=1.02). Because partial Gulf sturgeon cannot be taken, the observed lethal take value is rounded up to 2 Gulf sturgeon per consecutive 3-year period.

Additionally, as discussed above, dredged material screening by observers on hopper dredges is only partially effective, and observed interactions are expected to document only 50% of sturgeon entrained and killed by a hopper dredge (NMFS 2003a). Thus, the total anticipated lethal take of Gulf sturgeon by hopper dredge (observed and unobserved) is 4 Gulf sturgeon per consecutive 3-year period (2 x 2=4). This take level represents a total take per consecutive 3-year period for all dredging involved with this project (initial dredging and future maintenance dredging).

6.2.2 Relocation Trawling

Only adult Gulf sturgeon migrate into marine waters; other life stages have little to no movement into marine waters. Adult Gulf sturgeon are only susceptible to interaction with relocation trawls during the 4-5 months (November through March) they spend feeding in and around the barrier islands. During those winter months, because Gulf sturgeon are found near the bottom of the water column, they are likely to be captured by relocation trawls, which operate by dragging their nets along the sea floor. Data describing the Gulf sturgeon's swimming ability in the Suwannee River strongly indicated that they cannot continually swim against prevailing currents of greater than 1-2 m per second (Wakeford 2001). Thus, even though relocation trawls travel through the water at slow speeds, it is still highly unlikely that a Gulf sturgeon would be able to out-swim a relocation trawl. Relocation data indicate most Gulf sturgeon prefer sandy shoreline habitats in more shallow waters. In the single documented occurrence of an observed Gulf sturgeon capture by trawl net in federal waters, the depth of the tow and was much deeper 56.8 ft (17.3 m) than where Gulf sturgeon have previously been documented, showing that interactions can occur in deeper waters than previously believed. However, such deep-water interactions are still thought to be very rare, and the best available data indicate most sturgeon in the Gulf remain inshore.

Estimating the Extent of Effects

Data relating to Gulf sturgeon captures is spotty; however, state and federal fishery data is the most reliable source. The federal fishery observer program in the U.S. shrimp fishery was voluntary between 1992 through June 2007 with coverage typically less than 1% of total shrimping effort. No Gulf sturgeon were observed in a shrimp trawl during that period. Mandatory observer coverage was initiated in the Gulf of Mexico shrimp fishery in July 2007, and since then only 2 Gulf sturgeon have been observed captured: 1 in federal waters and 1 in state waters (Figure 12). Both of these captures were in main trawl nets in relatively shallow waters. The capture in federal waters (December 15, 2009) was nearby the Gulf barrier islands where preferred winter foraging habitat is located. Both of the Gulf sturgeon observed captured in shrimp trawls were released alive.

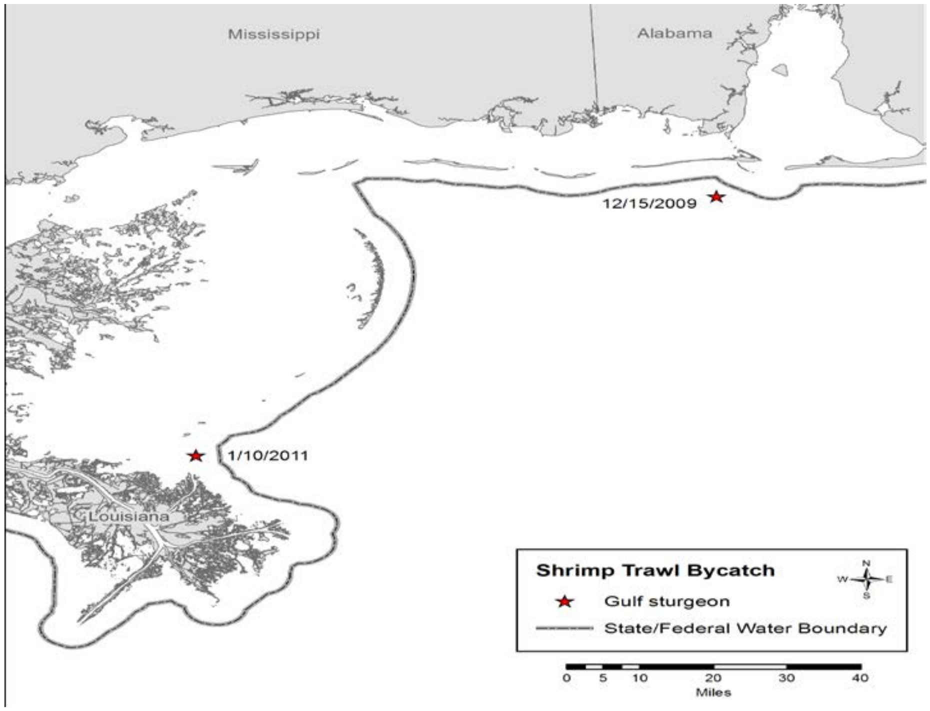

Figure 12. Location of observed Gulf sturgeon captures in shrimp trawls by date relative to state and federal fishing boundaries from Federal Fishery Observer Program 2012)

Since 2006, only 45 Gulf sturgeon have been captured in relocation trawls. One of the few recorded projects in the Gulf where Gulf sturgeon were captured in a relocation trawl in large numbers was the Gulf Shores/Orange Beach renourishment project. This project borrowed sand from an offshore borrow site and placed it along the beach profile using a hopper dredge and therefore was required to use a relocation trawl while this activity was in process. Over the course of 155 days (October 15, 2012 – November 25, 2012; November 19, 2012 – March 12, 2013) of dredging, relocation trawlers made 4,881 trawls and captured 95 sea turtles and 32 Gulf sturgeon. The capture of 32 Gulf sturgeon occurred in 2013. It should be noted that the capture of 32 Gulf sturgeon is extremely rare and is not expected to be the norm in any trawling event. This series of encounters was the result of relocation trawling on a productive winter feeding area. For contrast, the GRBO estimated that approximately 8 trawl-captured Gulf sturgeon would be taken in one year for the entire Gulf, although since 2006 only 13 Gulf sturgeon have been taken in the relocation trawl until 2013, and none have been taken in 2014 or 2015.

6.2.2.1 Nonlethal Take by Relocation Trawl

Calculation of Gulf Sturgeon Relocation Rates during Hopper Dredging
To calculate the number of Gulf sturgeon expected to be relocated, we consulted the USACE Sea Turtle Data Warehouse, the Operations and Dredging Endangered Species System (ODESS), and Engineer Research and Development Center (ERDC) for the number of Gulf sturgeon captured

from 2006-2015 in relocation trawls and the corresponding number of days of relocation trawling for each year. This was necessary to find the most applicable historic relocation trawling information for the project area. This data is summarized for both sea turtles and Gulf sturgeon in Table 18 below. A total of 428 sea turtles and 45 Gulf sturgeon were safely trawl-captured and released over 1,520 days of relocation trawling.

The probability for future capture is calculated based on the combined number of captures. This averages out to be approximately 0.311 (473÷1,520 = 0.311) listed species captured per relocation trawling day. Estimating the expected number of trawl-captured Gulf sturgeon during this project is difficult and necessarily imprecise, because of the uncertainties associated with the project, the various seasons, varying water temperatures differences in availability and location of Gulf sturgeon potential foraging habitat from year to year (which may cause Gulf sturgeon to move into or out of the action area), and different bottom substrates (sand and mud to hard clay) and topography (smooth vs. rough and undulating) over which the trawling may be performed (which affects capture trawling effectiveness). On average, 0.311 sea turtles and Gulf sturgeon were captured per day of relocation trawling. Relocation trawling for the Port of Gulfport Expansion Project will only occur during hopper dredging which will take 3 months (~90 days) per fiscal year.

Table 18. Gulf Sturgeon/Sea Turtle Relocation Trawling Efforts in Mobile District, 2006-2015

Fiscal Year	Days of Trawling	Loggerhead	Kemp's ridley	Green	Leatherback	Hawksbill	Gulf Sturgeon	Total Relocated Species
2006	269	62	41	4	2	0	13	122
2007	28	1	2	0	1	0	0	4
2008	0	0	0	0	0	0	0	0
2009	149	29	9	0	0	0	0	38
2010	56	2	2	0	0	0	0	4
2011	418	20	72	1	0	0	0	93
2012	73	5	3	0	0	0	0	8
2013	224	33	66	3	1	0	32	135
2014	0	0	0	0	0	0	0	0
2015	303	11	58	0	0	0	0	69
Total Mobile District Relocation Trawling Days	**1520**	**163**	**253**	**8**	**4**	**0**	**45**	**473**
Species Percentage		34%	53%	2%	1%	0%	10%	100%

Total Gulf Sturgeon Relocated	**45**
Listed Species per day	**0.311**

To determine the number of Gulf sturgeon expected to be relocated, we multiplied the species per day from Table 18 (0.311) times the number of possible relocation trawling days (90), which gives us the total anticipated amount of listed species to be captured by relocation trawl per fiscal year during the project (0.311x 90=27.99). We then calculate the species percentages or capture for previous relocation trawling efforts in the area from Table 18. This is calculated by dividing the sum of the captured Gulf sturgeon species by the total of all listed species captured (sturgeon and sea turtles) (45÷473=0.095) to determine the expected proportion of relocated Gulf sturgeon among all captures (Table 19). As calculated above, we expect 27.99 sea turtles and Gulf sturgeon to be relocated via relocation trawl, and when we apply the above species percentage for Gulf sturgeon, we end up with 2.66 Gulf sturgeon nonlethally relocated during the expected 90 days of relocation trawling per fiscal year (27.99 x 0.095=2.66).

Table 19. Gulf Sturgeon/Sea Turtle Relocation Trawling Species Composition

Trawling days: 90	Loggerhead	Kemp's ridley	Green	Leatherback	Hawksbill	Gulf Sturgeon	Total Gulf Sturgeon Relocated	Total Relocated
Species Percentage	34%	53%	2%	1%	0%	10%	-	100%
Turtles relocated	9.66	14.97	0.48	0.22	0.000	2.66	2.66	27.99

The number of captures in any given year can be based on reporting (as discussed above) and can also be influenced by sea temperatures, species abundances in a given year, fluctuating salinity levels, and other factors that cannot be predicted. For these reasons, we believe basing our future incidental take estimate on a 1-year estimated take level is largely impractical. For these reasons, and based on our experience monitoring other dredging activities, we believe a 3-year time period is appropriate for meaningful monitoring. The triennial takes are set as 3-year running sums (total for any consecutive 3-year period) and not for static 3-year periods (i.e., 2015-2017, 2016-2018, 2017-2019 and so on, as opposed to 2017-2019, 2020-2022). This approach reduces the likelihood reinitiation of ESA consultation will be required unnecessarily because of inherent variability in nonlethal take levels, while still allowing for an accurate assessment of how the proposed actions are performing versus our expectations. Thus, the total anticipated nonlethal take of Gulf sturgeon by relocation trawling for any consecutive 3-year time period is 7.98 individuals (2.66 x 3=7.98). Because partial Gulf sturgeon cannot be taken, the nonlethal take value is rounded up to 8 Gulf sturgeon per consecutive 3-year period.

6.2.2.2 Lethal Take by Relocation Trawl

Relatively few sturgeon have been reported as captured in trawl nets, and of those, many were released alive. Louisiana Division of Wildlife and Fisheries (LADWF) documented 177 Gulf sturgeon incidentally captured and reported by commercial fishers in southeastern Louisiana during 1992, of which 76 were captured in trawls, 10 in wing nets, and 91 in gillnets. LADWF noted an overall mortality rate of less than 1% (USFWS and GSMFC 1995). Although this information is dated, more recently, LADWF Gulf sturgeon researchers indicated they are often contacted by fishers who wish to have the live sturgeon tagged and released (H. Rogillio, LADWF, pers. comm. to S. Bolden, NMFS, December 2, 2002). Studies in a variety of trawl fisheries have shown that mortality of the conspecific Atlantic sturgeon incidentally caught in trawl gear is very low, with most surveys showing 0% mortality (e.g., Stein et al. 2004). Based on observer data from South Atlantic shrimp fisheries, 1 mortality was observed out of 9 Atlantic sturgeon that were incidentally captured in otter trawl gear between 2008 and 2011 (E. Scott-Denton, NOAA, pers. comm. Jenny Lee, NMFS PRD, April 18, 2014), for a mortality rate of 1 out of 9 captures or 11%. This is high compared to most reports for trawl fisheries. It may be an artifact of the low number of observed incidental captures of Atlantic sturgeon in shrimp trawl fisheries, or it may reflect some difference between shrimp trawling and other trawl fisheries, perhaps an effect of warmer, southern waters.

With the limited available data, based on the 1 Atlantic sturgeon mortality observed between 2008 and 2011, we anticipate 1 Gulf sturgeon mortality in the relocation trawl once every 4 years. Therefore, we believe that observed lethal captures will not exceed 1 for any consecutive 3-year period. This estimate of 1 lethal take by relocation trawling is not in addition to the estimates provided above; rather, it is part of the total estimated takes by relocation trawling. This take level represents a total take per consecutive 3-year period for all relocation trawling involved with this project (initial dredging and future maintenance dredging).

6.3 Effects to Gulf Sturgeon Critical Habitat

The project area includes winter migration and feeding habitats for adult and subadult Gulf sturgeon in Mississippi Sound, which includes individuals from the Pascagoula and the Pearl

River sub-populations, as well as the Blackwater, Choctawhatchee, Yellow, and Escambia River subpopulations (ERDC 2012). Dredging operations for this project will be continuous, operating 24 hours each day, 7 days a week. Dredge cycle periodicity is estimated to be variable (7-14 months; West Pier Expansion, East Pier Expansion, and West Pier Berthing and North Harbor Expansion) (18-47 months; Turning Basin) depending on the condition of the area. As noted in Section 3, prior to construction, the expansion footprint may require dredging for removal of soft to very soft foundation materials and to mitigate mud waves outside of the project footprint. After sediment removal, fill material will be sourced from onsite and offsite areas to build up and elevate the Port of Gulfport Expansion footprint, which will permanently impact 178.5 ac of GSCH by conversion to upland. Additionally, placement of a riprap breakwater along the eastern edge of the Gulfport navigational channel will permanently impact 18 ac of GSCH. Total fill impacts in GSCH will be 197 ac (179 +18=197).

The Final Rule which designates GSCH states that the abundance of prey items (such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusks, and/or crustaceans) within estuarine and marine habitats and substrates for subadult and adult life stages, are essential for the conservation of the species, as are suitable water quality and sediment characteristics, and safe and unobstructed migratory pathways.

The primary migration routes through the geographic area are in the nearshore area near the river mouths or through the barrier island passes. Incidental captures and recent studies confirm that adult Gulf sturgeon from both the Pearl and Pascagoula Rivers winter in the Mississippi Sound, particularly around barrier islands and passes (Reynolds 1993; Ross et al. 2009). Gulf sturgeon exiting the Pascagoula River move both east and west, with telemetry locations as far east as the west coast of Florida and as far west as Cat Island, and the entrance and the interior of Lake Pontchartrain, Louisiana (Ross et al. 2009) (Kayla Kimmel, USFWS, pers. comm., to Ryan Hendren, NMFS PRD, July 14, 2016). Tagged Gulf sturgeon from the Pearl River subpopulation have been located between Cat Island, Ship Island, Horn Island, and east of Petit Bois Island to the Alabama State line (ERDC 2012; Rogillio et al. 2001; Rogillio et al. 2007; Ross et al. 2009). Habitat used by Gulf sturgeon in the vicinity of the barrier islands is 6.2-19.4 ft deep (average 13.8 ft), with clean sand substrata (Heise et al. 1999; Ross et al. 2001a). The species is known to utilize Camille Cut inlets as well as the other 5 barrier island passes (Ship Island, Dog Keys, Little Dog Keys, Horn Island, Petit Bois) for feeding and congregating (ERDC 2012; Rogillio et al. 2007; Ross et al. 2009).

A 2-year (2012-2014) Gulf sturgeon monitoring study was conducted in the project area consisting of telemetry-tagged Gulf sturgeon and 19 acoustic receivers. The study deployed a series of acoustic array “gates,” which detected tagged Gulf sturgeon movements between the Pearl and Pascagoula Rivers. The appearance of Gulf sturgeon in the array occurred during established and well-documented immigration (February–April) and emigration (September–December) periods (Appendix N of the EIS - Peterson et al. 2015). Results of the study indicate that the area is used by Gulf sturgeon, but more importantly, that the existing Port of Gulfport is not impeding the species’ migration within the Mississippi Sound. Since the construction of the original Port did not prevent Gulf sturgeon from migrating through Mississippi Sound as needed, NMFS does not believe that expansion of the Port will keep sturgeon from moving to and from their preferred feeding and sheltering areas and river systems. The placement of material will occur in primarily open-water areas, and it is likely that the highly mobile Gulf sturgeon will avoid these areas due to project activities (noise and the physical presence of machinery). NMFS believes there will be sufficient passage opportunity for Gulf sturgeon to move through the placement area via the adjacent open-water areas during the placement activities and after their completion, so that migratory pathways will not be disrupted. No other significant short-term or long-term impacts to the migratory passage PBF feature have been identified. Therefore, NMFS expects the placement of dredge and fill material and the eastern breakwater will have an insignificant effect on the ability of GSCH Unit 8 to provide migratory pathways for Gulf sturgeon.

Abundance and diversity of prey items, water quality, and sediment PBFs within the expanded pier, harbor, and breakwater footprint will be permanently impacted through conversion of open water to uplands (i.e., displacement of all 3 PBFs by fill material). Periodic maintenance dredging, and open water disposal areas will temporarily affect GSCH by dredged material removal and placement into the open-water areas (Table 3, Figure 2). The non-motile benthic faunal community, benthos, and water column within the footprint of this projects' placement areas would be lost (both permanently and temporarily) as a result of dredge and placement activities. In the pier and harbor maintenance dredge areas, and open water placement areas, the benthic fauna is expected to recover, typically within 1 year of completion of the project, however recovery is typically achieved within 3–10 months of thin-layer disposal (Saloman et al. 1982; Wilber et al. 2007). Future maintenance dredging activities will be variable (7-14 months; West Pier Expansion, East Pier Expansion, and West Pier Berthing and North Harbor Expansion) depending on the condition of the area. Dredged material placement impacts will be localized and affect the benthic community within the immediate footprint of the placement areas. Unit 8 of GSCH encompasses a total of 881,421 ac. The combined GSCH areas affected by the project (permanently and temporarily), are approximately 0.02% (197 ac/ 881,421 ac = 0.0002 x 100 = 0.02%) of that GSCH Unit 8 total.

6.3.1 Gulf Sturgeon Subpopulations Using Affected Critical Habitat

GSCH Unit 8 provides juvenile, subadult, and adult feeding, resting, and passage habitat for Gulf sturgeon from the Pascagoula and the Pearl River sub-populations, as well as subpopulations from river systems to the east such as the Blackwater, Choctawhatchee, Yellow, and Escambia River (ERDC 2012). The project area is located west of the East and West Branch of the Pascagoula River. Ross et al. (2001a) has investigated the movement of fish exiting both the East and West Branches of the Pascagoula River (n = 19) and found that most fish move close to the nearby barrier islands (Cat, Ship, Horn, and Petit Bois Islands) and are most commonly found in the passes between the islands in areas of clean sand substrates. In Rogillio et al. (2001), while tracking Gulf sturgeon from the Pearl River (n = 25) also observed fish (n = 7) in the passes between these barrier islands. Other studies have repeatedly observed Gulf sturgeon in areas during foraging periods in areas of predominated by sandy substrate and barrier island passes (Fox et al. 2002; USACE 2012).

Sturgeon from 6 of these sub-populations have been recently observed foraging within the barrier islands of Unit 8. However, the actual number of Gulf sturgeon utilizing the project area for foraging is likely few. The total number of Gulf sturgeon using the affected critical habitat is unknown as there are no current population estimates for either the Pearl or Pascagoula Rivers. Still, populations in the Pearl and Pascagoula Rivers have never been as abundant as those to the east, as observed in recent monitoring on Ship Island (ERDC 2012). Prior to hurricanes Ivan and Katrina, the number of Gulf sturgeon was estimated at about 430 in the Pearl River (Rogillio et al. 2001) and around 216 in the Pascagoula River (Ross et al. 2001a). Effects of those hurricanes to the populations within the Pearl and Pascagoula Rivers are unknown as research has since been limited in those systems (USFWS and NMFS 2009). In a recent monitoring report for the Mississippi Coastal Improvement Program (ERDC 2012), results of an acoustic telemetry array have documented at least 63 tagged Gulf sturgeon originating from 6 rivers: Pearl (16), Pascagoula (20), Blackwater (16), Choctawhatchee (4), Yellow (3), and Escambia (4). These Gulf sturgeon were documented utilizing the Camille Cut opening and ends of Ship Island for staging and foraging (T. Slack, USACE ERDC, pers. comm. to R. Hendren, NMFS PRD, July 27, 2015). However, these sturgeon are presumed to forage along all the barrier islands between Cat Island and Petit Bois Island.

A recent study by (Peterson et al. 2015) in preparation for this project observed Gulf sturgeon movements between the Pearl and Pascagoula Rivers along the inshore area. The study noted that the existing Port of Gulfport is not impeding migration within the Mississippi Sound. Most of the sturgeon detected were from the Pearl and Pascagoula drainages but there were some eastern population fish (Escambia and Choctawhatchee drainages) that appeared in the Gulfport array. The detection data indicates that Gulf Sturgeon occurrences are more concentrated on east gate and eastern portion of the Gulfport array compared to the west gate and western portion of the array. This suggests that this area to the east of the Port of Gulfport is more suitable habitat, a feeding zone, or a pre-/post-migratory acclimation zone. The data also shows that sturgeon mostly passed through the Port of Gulfport area, indicating that the habitat within the construction/dredge foot print is less suitable than the surrounding areas for foraging.

6.3.2 Prey Items

Developmental changes (from birth to adult) in Gulf sturgeon diet and foraging area have been documented. Adults forage sparingly in freshwater and depend almost entirely on estuarine and marine prey for their growth (Gu et al. 2001). Both adult and subadult Gulf sturgeon are known to lose up to 30% of their total body weight while in freshwater, and subsequently compensate the loss during winter feeding in marine areas (Carr 1983; Clugston et al. 1995; Heise et al. 1999; Morrow et al. 1998; Ross et al. 2000; Sulak and Clugston 1999; Wooley and Crateau 1985). Upon exiting the rivers, Gulf sturgeon concentrate around the mouths of their natal rivers in lakes and bays. These areas are very important for the Gulf sturgeon as they offer the first foraging opportunity for the Gulf sturgeon exiting the rivers. Gulf sturgeon have been described as opportunistic and indiscriminate benthivores; their guts generally contain benthic marine invertebrates including amphipods, lancelets, polychaetes, gastropods, shrimp, isopods, mollusks, and crustaceans (Carr et al. 1996; Fox et al. 2000; Fox et al. 2002; Huff 1975; Mason Jr. and Clugston 1993). During the early fall and winter, immediately following downstream migration, Gulf sturgeon are most often located in depths less than 20 ft in sandy areas that support burrowing macroinvertebrates, where the fish are presumably foraging (Craft et al. 2001; Fox et al. 2002; Parauka et al. 2001; Ross et al. 2001b). Generally, Gulf sturgeon prey are burrowing species (e.g., annelids: polychaetes and oligochaetes, amphipods, isopods, and lancelets) that feed on detritus and/or suspended particles, and inhabit sandy substrate.

NMFS expects that prey items will be impacted both permanently and temporarily within the project footprint. The Port of Gulfport Expansion footprint (West Pier, East Pier, West Pier Berthing, and West Pier Berthing, and North Harbor) and breakwater, will permanently impact (179 + 18) 197 ac of GSCH by conversion from open water to upland. Periodic maintenance dredging will temporarily affect GSCH by dredged material removal and disposal. Details of effects are discussed further in the following sections: Benthic Community Structure and Recovery of Benthic Biota.

6.3.3 Benthic Community Structure

The benthic community structure in the Port of Gulfport Expansion footprint and the breakwater footprint along the eastern edge of the Gulfport navigational channel will be modified by the placement of fill. The fill will convert submerged habitat into upland resulting in a loss of potential foraging habitat. However the loss of potential foraging habitat will be small in comparison to the overall size of Unit 8 (less than 0.02% of area within Unit 8). Periodic maintenance dredging will modify GSCH, but the impacts are expected to be temporary. The benthic community structure within the project footprint was assessed in April of 2012 by Atkins (Atkins 2015). Preferred habitat (described as shallow water (<13 ft) over sandy substrate with water quality characteristics, such as high dissolved oxygen (DO) content (>7.2 milligrams per liter [mg/L]) that also contained 2 or 3 organisms known to occur in adult diets) for the Gulf sturgeon within the Project footprint was located in the West Pier Berthing and North Harbor Expansion, West Pier Expansion, and west of the West Pier Expansion areas. However these areas appeared to be of marginal suitability for foraging. The muddy substrate in the action area was found to support a total of 105 benthic macroinvertebrate taxa with polychaete worms, ribbon worms, decapods, amphipods, and bivalves most common in the study area. While the absolute biomass of benthic meiofauna (smaller that macro that live in both marine and fresh water environments) and benthic macrofauna (defined as being larger than 2 mm in size) is not totally dependent upon sediment grain size, community structure and faunal size directly correlate to benthic substrate (Parsons et al. 1984). In addition to the prey items, the sediment and overlying water column that support the benthic community will be also be lost due to project fill activities.

Upon review of the study and its findings, NMFS expects that the proposed action will permanently remove the GSCH benthic community structure (Gulf sturgeon prey PBF) in the Port of Gulfport Expansion footprint and the breakwater footprint (197 ac). This action will also temporarily affect the benthic community structure, sediment quality, and water quality in maintenance dredged areas.

6.3.4 Recovery of Benthic Biota

Maintenance dredging of material will temporarily impact potential foraging habitat within Unit 8 of designated GSCH; however, the affected areas will recover within 3-24 months (Culter and Mahadevan 1982; Wilber et al. 2007). Therefore, although prey abundance will be adversely affected, NMFS expects these effects to be temporary and recovery of prey abundance and availability will occur within a relatively short period of time. The area within Port of Gulfport Expansion footprint and the breakwater footprint will be permanently converted to uplands, and the loss of this habitat will adversely affect the GSCH.

6.3.5 Water Quality

Maintenance dredging and placement of material associated with this project will create some degree of turbidity in excess of the natural conditions. Water quality impacts from turbidity as a result of dredging and material placement are expected to be temporary and localized, with suspended particles settling out within a short time frame without measurable effects on water quality. In addition, Mississippi Sound is a naturally turbid waterbody (especially during periods of high winds, currents, and waves) to which animals occurring there are adapted. The water column's dissolved oxygen levels may be temporarily lowered during dredge and fill operations, but this impact will also be temporary and localized with dissolved oxygen returning to ambient levels within a short time.

In contrast, Port expansion fill activities will permanently remove the water column, and therefore the water quality PBF, from 197 ac of GSCH. Fill activities in the expansion footprint and the breakwater footprint will be permanently converted from open water to uplands, and the loss of this habitat (water column) will adversely affect the GSCH.

6.3.6 Sediment Quality

The permanent placement of fill material (sand and riprap) will cover approximately 197 acres of bottom sediments. These sediments contain textural and chemical characteristics that could be used by Gulf sturgeon (e.g., as feeding or resting areas). Fill activities in the expansion footprint and the breakwater footprint will be permanently converted to uplands, and the loss of this habitat (sediment) will adversely affect the sediment quality PBF of GSCH as the affected sediments will no longer be available for Gulf sturgeon to use.

The dredging and thin-layer placement of maintenance dredge material at the open-water sites to the west of the FNC in single 6- to 12-inch lifts over the surface area will not affect the sediment quality PBF as the dredge material will be similar in composition to the sediments at the disposal sites.

6.3.7 Summary of Effects on Gulf Sturgeon Critical Habitat

The proposed project will have both permanent and temporary effects to GSCH. Gulf sturgeon prey abundance has the ability to recover as prey recolonizes the areas impacted by maintenance dredging and thin-layer disposal. Recovery of the macrobenthic assemblages is expected, as sediment composition pre- and post-dredge at the disposal areas will be similar and benthic assemblages are known to recover relatively quickly from physical disturbance. The alteration of water quality due to maintenance dredging will also be temporary and is expected to return to ambient conditions shortly after the cessation of dredging activities. However, the conversion of submerged habitat to upland will permanently modify the 197 ac of GSCH.

While habitat known to support prey will be both permanently and temporarily impacted, it is likely that any Gulf sturgeon in the project area have the ability to find appropriate and abundant prey in the areas adjacent to the project location, as many other nearby similar prey-rich sandy areas exist. Given that Gulf sturgeon forage opportunistically while benthic cruising, they can just as easily locate prey and fulfill nutritional requirements in areas adjacent to those are impacted.

While the Port of Gulfport Expansion footprint is not likely utilized for foraging by Gulf sturgeon, the permanent fill and conversion to upland is considered an adverse impact to GSCH. However, the loss of potential foraging habitat will be small (less than 0.02% of area within Unit 8) compared to the total acreage found within Unit 8 of GSCH and will not affect the overall function of GSCH conservation and recovery ability.

As noted above, based on the outcome of similar dredge material disposal projects, the USACE anticipates the temporary reduction of benthic prey available and short-term alteration of water quality within the maintenance dredge footprint will not significantly affect the critical habitat's ability to support the Gulf sturgeon's conservation in the short or long term. This is supported by the current population estimates and the ability of the benthic community to recover within a reasonably short duration. NMFS concludes the effects on the GSCH prey abundance PBF, sediment PBF, and water quality PBF will be adverse; however, as explained in Section 9, the effects of the project will not impact the function of GSCH Unit 8, and that it will continue to serve its intended conservation role for Gulf sturgeon.

7 CUMULATIVE EFFECTS

ESA Section 7 regulations require NMFS to consider cumulative effects in formulating their Biological Opinions (50 CFR 402.14). Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion.

Cumulative effects from unrelated, non-federal actions occurring in the area may affect GSCH. Dredging, beach nourishment, creation of artificial reefs, breakwaters, jetties, groins, and dredge placement within the littoral zone, are anticipated to occur within Unit 8 of GSCH. However, where possible, conservation actions through the ESA Section 7 process and state permitting programs are being implemented to monitor or prevent impacts from these sources.

In terms of vessel traffic at the Port post-expansion, the goal of the Port expansion is to make the Port more competitive with other ports in the Gulf of Mexico, so that vessels that might have gone to other ports will come to the Port of Gulfport instead. It is not expected that the Port expansion will bring more vessels into the Gulf of Mexico. It may redistribute commercial vessel traffic in the Gulf and bring more vessels into the Port of Gulfport, but these vessels would have traveled to different Gulf of Mexico ports, so it is not expected to cause an increased risk of collisions with listed species (P. Hegji, USACE, pers. comm. to D. Rydene, NMFS, June 22, 2017). In other words, any increase in interactions between commercial vessels and listed species associated with the expansion of the Port of Gulfport would be offset by fewer interactions at other ports in the Gulf of Mexico due to less vessel traffic at those ports.

As noted in the baseline, effects related to the DWH oil spill are not fully known at this time. Routes of exposure are generally believed to be (1) suffocation of infaunal organisms, and (2) toxicity of substrate. Both of these effects would impact potential foraging areas within GSCH through the displacement and/or reduction of prey items. Some emergency restoration efforts pursuant to the Oil Pollution Act have yet to be determined and implemented, and so the ultimate restoration impacts on the species are unknowable at this time.

Coastal runoff and river discharges carry large volumes of petrochemical and other contaminants from agricultural activities, cities, and industries into the Gulf of Mexico. The coastal waters of the Gulf of Mexico have more sites with high contaminant concentrations than other areas of the coastal United States due to the large number of waste discharge point sources. Chemicals and metals such as chlordane, DDE, DDT, dieldrin, PCBs, cadmium, mercury, and selenium settle to the substrate and are later incorporated into the food web as they are consumed by benthic feeders, such as sturgeon or macroinvertebrates. Some of these compounds may affect the surrounding environment by reducing DO, altering pH, and altering other water quality properties.

Although little is known about contaminant effects on GSCH, general studies on sturgeon habitats indicate that the effects of contaminants and pollution contribute to lost habitat (Barannikova 1995; Shagaeva et al. 1993; Verina and Peseridi 1979).

8 JEOPARDY ANALYSIS

The analyses conducted in the previous sections of this Opinion serve to provide a basis to determine whether the proposed action would be likely to jeopardize the continued existence of affected ESA-listed sea turtles and Gulf sturgeon. In Section 6, we outlined how the proposed action can affect sea turtles and sturgeon and the extent of those effects in terms of estimates of the numbers of each species expected to be killed or captured. Now, we turn to an assessment of each species' response to this impact, in terms of overall population effects from the estimated take, and whether those effects of the proposed action, when considered in the context of the status of the species (Section 4), the environmental baseline (Section 5), and the cumulative effects (Section 7), will jeopardize the continued existence of the affected species.

It is the responsibility of the action agency to ensure that "any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species…" (ESA Section 7(a)(2)). Action agencies must consult with and seek assistance from the Services to meet this responsibility. The Services must ultimately determine in a Biological Opinion whether the action jeopardizes listed species. "To jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and the recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). Thus, in making this determination, NMFS must look at whether the action directly or indirectly reduces the reproduction, numbers, or distribution of a listed species. Then, if there is a reduction in one or more of these elements, we evaluate whether it would be expected to cause an appreciable reduction in the likelihood of both the survival and the recovery of the species. In the following section, we evaluate the responses of loggerhead (NWA DPS), green (NA and SA DPSs), and Kemp's ridley sea turtles, and Gulf sturgeon, to the effects of the action.

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

The lethal (observed and unobserved) take of up to 16 sea turtles (consisting of up to 8 Kemp's ridley, 6 loggerhead, and 2 green sea turtles)[13] and up to 4 Gulf sturgeon by hopper dredges and relocation trawling during consecutive 3-year periods will result in a temporary reduction in total population numbers (Table 20). Sea turtle and Gulf sturgeon mortality resulting from hopper dredges and relocation trawling could result in the loss of reproductive value of an adult turtle or sturgeon. 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 and Gulf sturgeon reproduction. While the death of any early life history stage individuals is regrettable, their value in terms of reproductive potential is considerably less than that of an equal number of adults.

Table 20. Amount of Authorized Observed and Unobserved Take during the Port of Gulfport Expansion Project and Associated Relocation Trawling per Consecutive 3-year Periods

During Dredging	Loggerhead	Kemp's ridley	Green	Leatherback	Gulf sturgeon
Total Species Lethally Taken	6	8	2	0	4
During Relocation Trawling					
Total Species Nonlethally Taken	29	45	2	1	8
Total Species Lethally Taken	1[14]	1[15]	1[16]	0	1[17]

8.1 Loggerhead NWA DPS

The potential nonlethal capture and release of 29 loggerhead sea turtles during consecutive 3-year periods is not expected to have a measurable impact on the reproduction, numbers, or distribution of this species. The individuals suffering nonlethal injuries are expected to fully recover such that no reductions in reproduction or numbers of loggerhead sea turtles are anticipated. The captures may occur anywhere in the action area, and the action area encompasses a tiny portion of the overall range/distribution of the NWA DPS of loggerhead sea turtles. Since any incidentally caught animal would be released within the general area where caught, no change in the distribution of loggerhead sea turtles is anticipated.

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13 The sum of the individual sea turtle lethal takes does not add up to 16 because only 1 lethal sea turtle take due to relocation trawling is authorized which may be any of 3 sea turtle species (loggerhead, Kemp's ridley, or green).

14 NMFS believes that 1 sea turtle will be captured lethally during consecutive 3-year periods. NMFS estimates that the lethal trawling interaction will most likely consist of a Kemp's ridley sea turtle, the most common species in the action area, but it is possible that the single turtle could be either a loggerhead or green sea turtle.

15 *Ibid*.

16 *Ibid*.

17 The potential lethal take of 1 Gulf sturgeon during relocation trawling is considered part of the potential 8 nonlethal takes and is not in addition to those 8 takes.

The lethal capture of up to 7 loggerhead sea turtles during consecutive 3-year periods associated with the proposed action represent a reduction in numbers. These lethal captures would also result in a future reduction in reproduction as a result of lost reproductive potential, as some of these individuals would be females who would have survived other threats and reproduced in the future, thus eliminating each female individual's contribution to future generations. For example, an adult female loggerhead sea turtle can lay 3 or 4 clutches of eggs every 2-4 years, with 100-130 eggs per clutch. Thus the loss of adult female sea turtles could preclude the production of thousands of eggs and hatchlings of which a small percentage would be expected to survive to sexual maturity. A reduction in the distribution of loggerhead sea turtles is not expected from lethal takes attributed to the proposed action. Because all the potential interactions are expected to occur at random throughout the proposed action area, which accounts for a tiny fraction of the species' overall range, the distribution of loggerhead sea turtles is expected to be unaffected.

Whether or not the reductions in loggerhead sea turtle numbers and reproduction attributed to the proposed action would appreciably reduce the likelihood of survival for loggerheads depends on what effect these reductions in numbers and reproduction would have on overall population sizes and trends, i.e., whether the estimated reductions, when viewed within the context of the environmental baseline, status of the species, and cumulative effects are of such an extent that adverse effects on population dynamics are appreciable. In Section 4, we reviewed the status of the species in terms of nesting and female population trends and several of the most recent assessments based on population modeling. Below, we synthesize what that information means in general terms and in the more specific context of the proposed action.

Loggerhead sea turtles are a slow growing, late-maturing species. Because of their longevity, loggerhead sea turtles require high survival rates throughout their life to maintain a population. In other words, late-maturing species cannot tolerate much anthropogenic mortality without going into decline. Conant et al. (2009a) concluded loggerhead natural growth rates are small, natural survival needs to be high, and even low to moderate mortality can drive the population into decline. Because recruitment to the adult population takes many years, population modeling studies suggest even small increased mortality rates in adults and subadults could substantially impact population numbers and viability (Chaloupka and Musick 1997; Crouse et al. 1987; Crowder et al. 1994).

NMFS-SEFSC (2009b) estimated the minimum adult female population size for the NW Atlantic DPS in the 2004-2008 timeframe to likely be between approximately 20,000-40,000 individuals (median 30,050), with a low likelihood of being as many as 70,000 individuals. Another estimate for the entire western North Atlantic population was a mean of 38,334 adult females using data from 2001-2010 (Richards et al. 2011). A much less robust estimate for total benthic females in the western North Atlantic was also obtained, with a likely range of approximately 30,000-300,000 individuals, up to less than 1 million.

NMFS-NEFSC (2011) preliminarily estimated the loggerhead population in the Northwestern Atlantic Ocean along the continental shelf of the Eastern Seaboard during the summer of 2010 at 588,439 individuals (estimate ranged from 381,941 to 817,023) based on positively identified individuals. The NMFS-NEFSC's point estimate increased to approximately 801,000 individuals when including data on unidentified sea turtles that were likely loggerheads. The NMFS-NEFSC (2011) underestimates the total population of loggerheads since it did not include Florida's east coast south of Cape Canaveral or the Gulf of Mexico, which are areas where large numbers of loggerheads are also expected. In other words, it provides an estimate of a subset of the entire population.

Florida accounts for more than 90% of U.S. loggerhead nesting. The Florida Fish and Wildlife Conservation Commission conducted a detailed analysis of Florida's long-term loggerhead nesting data (1989-2016). They indicated that following a 24% increase in nesting between 1989 and 1998, nest counts declined sharply from 1999 to 2007. However, annual nest counts showed a strong increase (71%) from 2008 to 2016. Examining only the period between the high-count nesting season in 1998 and the most recent nesting season (2016), researchers found a slight but nonsignificant increase, indicating a reversal of the post-1998 decline. The overall change in counts from 1989 to 2016 was significantly positive; however, it should be noted that wide confidence intervals are associated with this complex data set (http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/).

As described in the Status of Species section, we believe that the DWH oil spill event had an adverse impact on loggerhead sea turtles, and resulted in mortalities of individuals, along with lingering impacts resulting from nest relocations, nonlethal exposure, and foraging resource impacts. However, there is no information to indicate, or basis to believe, that a significant population-level impact has occurred that would have changed the species' status to an extent that the expected interactions with proposed action activities would result in a detectable change in the population status of the NWA DPS of loggerhead turtles. This is especially true given the size of the population and that, unlike Kemp's ridleys, the NWA DPS is proportionally much less intrinsically linked with the Gulf of Mexico.

It is possible that the DWH oil spill event reduced that survival rate of all age classes to varying degrees, and may continue to do so for some undetermined time into the future. However, there is no information at this time that it has, or should be expected to have, substantially altered the long-term survival rates in a manner that would significantly change the population dynamics compared to the conservative estimates used in this Opinion. Any impacts are not thought to alter the population status to a degree in which the number of mortalities from the proposed action could be seen as reducing the likelihood of survival and recovery of the species.

Abundance estimates accounting for only a subset of the entire loggerhead sea turtle population in the western North Atlantic indicate the population is large (i.e., several hundred thousand individuals). Nesting trends have been significantly increasing over several years against the background of the past and ongoing human and natural factors (environmental baseline) that have contributed to the current status of the species. Additionally, our estimate of future captures is not a new source of impacts on the species. The same or a similar level of captures has occurred in the past, yet we have still seen positive trends in the status of this species.

The proposed action could remove up to 7 individuals during consecutive 3-year periods. These removed individuals represents approximately 0.00183% over 3 years of the low end of the NMFS (2011) estimate that reflects a subset of the entire loggerhead population in the western

North Atlantic Ocean. While the loss of 7 individuals during consecutive 3-year periods is an impact to the population, in the context of the overall population's size and current trend, it would not be expected to result in a detectable change to the population numbers or trend. After analyzing the magnitude of the effects of the proposed action, in combination with the past, present, and future expected impacts to the DPS discussed in this Opinion, we believe the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the loggerhead sea turtle DPS in the wild.

Recovery

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might affect its likelihood of recovery or the rate at which recovery is expected to occur to an extent that the species' continued existence is jeopardized. NMFS has determined above, that the proposed action will not appreciably reduce the likelihood that loggerhead sea turtles will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. The loggerhead recovery plan defines the recovery goal as "…ensur[ing] that each recovery unit meets its Recovery Criteria alleviating threats to the species so that protection under the ESA is no longer necessary" (NMFS and USFWS 2008b). The plan then identifies 13 recovery objectives needed to achieve that goal. We do not believe the proposed action impedes the progress of the recovery program or achieving the overall recovery strategy.

The recovery plan for the Northwest Atlantic population of loggerhead sea turtles (NMFS and USFWS 2009) lists the following recovery objectives that are relevant to the effects of the proposed action:

> *Objective*: 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

> *Objective*: Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes

Recovery is the process of removing threats so self-sustaining populations persist in the wild. The proposed action would not impede progress on carrying out any aspect of the recovery program or achieving the overall recovery strategy. The recovery plan estimates that the population will reach recovery in 50-150 years following implementation of recovery actions. The minimum end of the range assumes a rapid reversal of the current declining trends; the higher end assumes that additional time will be needed for recovery actions to bring about population growth.

Nesting trends have been significantly increasing over several years. As noted previously, we believe the future takes predicted will be similar to the levels of take that has occurred in the past and those past takes did not impede the positive trends we are currently seeing in nesting during that time. We also indicated that the potential lethal take of 6 loggerhead sea turtles during consecutive 3-year periods is so small in relation to the overall population, that it would be hardly detectable, even when considered in the context of the Status of the Species, the

Environmental Baseline, and Cumulative Effects discussed in this Opinion. We believe this is true for both nesting and juvenile in-water populations.

The nesting trend over the last 2 decades appears to be evidence of an increasing population against the background of the past and ongoing human and natural factors (environmental baseline) that have contributed to the current status of the species. For these reasons, we do not believe the proposed action will impede achieving recovery.

Conclusion

The lethal and nonlethal captures of loggerhead sea turtles associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the NWA DPS of the loggerhead sea turtle in the wild.

8.2 Green Sea Turtles (NA DPS and SA DPS)

As discussed in the Section 4.3 this Opinion, within U.S. waters individuals from both the green sea turtle NA and SA DPSs can be found on foraging grounds, and we expect individuals from both DPSs to be found in waters in the action area for the proposed project. To analyze effects in a precautionary manner, we will conduct two jeopardy analyses, one for each DPS (i.e., assuming animals would be taken from both DPSs). An analysis of cold-stunned green turtles in St. Joseph Bay, Florida (northern Gulf of Mexico) found approximately 4% of individuals came from nesting stocks in the SA DPS (specifically Suriname, Aves Island, Brazil, Ascension Island, and Guinea Bissau) (Foley et al. 2007). We will analyze impacts to the SA DPS assuming that 4% of the takes would come from that DPS, while assuming 96% of takes will come from the NA DPS. A maximum of 3 lethal green sea turtle takes during consecutive 3-year periods might occur (Table 20). While all 3 might come from the NA DPS, it is possible that 1 might come from the SA DPS. Additionally, a maximum of 2 nonlethal green turtle takes during consecutive 3-year periods might occur. While both might come from the NA DPS, it is possible that 1 might come from the SA DPS.

8.2.1 Green Sea Turtle NA DPS

The potential nonlethal capture of 2 green sea turtles from the NA DPS (relocation trawling) during consecutive 3-year periods is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. The individuals suffering nonlethal injuries or stresses are expected to fully recover such that no reductions in reproduction or numbers of green sea turtles are anticipated. The captures may occur anywhere in the action area, which encompasses only a tiny portion of green sea turtles' overall range/distribution within the NA DPS. Any animal incidentally caught during relocation trawling would be released within the general area where caught, no change in the distribution of NA DPS green sea turtles is anticipated.

The proposed action could lethally take up to 3 NA DPS green sea turtles during consecutive 3-year periods (2 by lethal hopper dredge interaction, and a possible additional lethal capture in a relocation trawl). The potential lethal take of 3 individuals from the NA DPS of green sea turtles during consecutive 3-year periods would reduce the number of NA DPS green sea turtles, compared to their numbers in the absence of the proposed action, assuming all other variables remained the same. Lethal interactions would also result in a potential reduction in future reproduction, assuming some individuals would be females and would have survived otherwise to reproduce. For example, as discussed in this Opinion, an adult green sea turtle can lay up to 7 clutches (usually 3-4) of eggs every 2-4 years, with up to an average of 136 eggs/nest, of which a small percentage is expected to survive to sexual maturity. The anticipated lethal interactions are expected to occur anywhere in the action area and only affect a small portion of the DPS, and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of green sea turtles within the NA DPS is expected from these captures.

Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends, i.e., whether the estimated reductions, when viewed within the context of the environmental baseline, status of the species, and cumulative effects are of such an extent that adverse effects on population dynamics are appreciable. In Section 4, we reviewed the status of the species in terms of nesting. Below, we synthesize what that information means in general terms and in the more specific context of the proposed action.

Seminoff et al. (2015) estimated that there are greater than 167,000 nesting females in the NA DPS. The nesting at Tortuguero, Costa Rica, accounts for approximately 79% of that estimate (approximately 131,000 nesters), with Quintana Roo, Mexico, (approximately 18,250 nesters; 11%), and Florida, USA (approximately 8,400 nesters; 5%) also accounting for a large portion of the overall nesting (Seminoff et al. 2015).

At Tortuguero, Costa Rica, the number of nests laid per year from 1999 to 2010 increased, despite substantial human impacts to the population at the nesting beach and at foraging areas (Campell and Lagueux 2005; Troëng 1998; Troëng and Rankin 2005).

Nesting locations in Mexico along the Yucatan Peninsula also indicate the number of nests laid each year has increased (Seminoff et al. 2015). In the early 1980s, approximately 875 nests/year were deposited, but by 2000 this increased to over 1,500 nests/year (NMFS and USFWS 2007a)(NMFS and USFWS 2007a). By 2012, more than 26,000 nests were counted in Quintana Roo (J. Zurita, CIQROO, unpubl. data, 2013, in Seminoff et al. 2015)

In Florida, most nesting occurs along the Atlantic coast of eastern central Florida, where a mean of 5,055 nests were deposited each year from 2001 to 2005 (Meylan et al. 2006) and 10,377 each year from 2008 to 2012 (B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm., 2013). As described in the Section 3.2.4, nesting has increased substantially over the last 20 years and peaked in 2015 with 27,975 nests statewide. In-water studies conducted over 24 years in the Indian River Lagoon, Florida, suggest similar increasing trends, with green sea turtle captures up 661% (Ehrhart et al. 2007). Similar in-water work at the St. Lucie Power Plant site revealed a significant increase in the annual rate of capture of immature green sea turtles over 26 years (Witherington et al. 2006).

In summary, nesting at the primary nesting beaches has been increasing over the course of the decades, against the background of the past and ongoing human and natural factors (environmental baseline) that have contributed to the current status of the species. We believe these nesting trends are indicative of a species with a high number of sexually mature individuals. Since the abundance trend information for NA DPS green sea turtles is clearly increasing, we believe the potential lethal take of 3 green sea turtles from the NA DPS during consecutive 3-year periods attributed to the proposed action will not have any measurable effect on that trend. After analyzing the magnitude of the effects of the proposed action, in combination with the past, present, and future expected impacts to the DPS discussed in this Opinion, we believe the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the green sea turtle NA DPS in the wild.

Recovery

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might affect its likelihood of recovery or the rate at which recovery is expected to occur to an extent that the species' continued existence is jeopardized. NMFS has determined above, that the proposed action will not appreciably reduce the likelihood that green sea turtles (NA DPS) will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. The NA DPS of green sea turtles does not have a separate recovery plan at this time. However, an Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991) does exist. Since the animals within the NA DPS all occur in the Atlantic Ocean and would have been subject to the recovery actions described in that plan, we believe it is appropriate to continue using that Recovery Plan as a guide until a new plan, specific to the NA DPS, is developed. The Atlantic Recovery Plan lists the following relevant recovery objectives over a period of 25 continuous years:

> *Objective: The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years.*
>
> *Objective: A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.*

According to data collected from Florida's index nesting beach survey from 1989-2015, green sea turtle nest counts across Florida have increased approximately ten-fold from a low of 267 in the early 1990s to a high of 27,975 in 2015 (http://myfwc.com/research/wildlife/sea-turtles/nesting/2015-nesting-trends/). There are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds. Given the clear increases in nesting, however, it is likely that numbers on foraging grounds have increased.

The potential lethal take of up to 3 NA DPS green sea turtles during consecutive 3-year periods will result in a reduction in numbers when captures occur, but it is unlikely to have any detectable influence on the recovery objectives and trends noted above, even when considered in the context of the of the Status of the Species, the Environmental Baseline, and Cumulative Effects discussed in this Opinion. Nonlethal captures of these sea turtles would not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action will not impede achieving the recovery objectives above and will not result in an appreciable reduction in the likelihood of NA DPS green sea turtles' recovery in the wild.

Conclusion

The lethal and nonlethal take of green sea turtles from the NA DPS associated with the proposed action is not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the NA DPS of green sea turtle in the wild.

8.2.2 Green Sea Turtle SA DPS

The potential nonlethal capture of up to 1 green sea turtle from the SA DPS (relocation trawling) during consecutive 3-year periods is not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. The individuals suffering nonlethal injuries or stresses are expected to fully recover such that no reductions in reproduction or numbers of green sea turtles are anticipated. The captures may occur anywhere in the action area and the action area encompasses a tiny portion of green sea turtles' overall range/distribution within the SA DPS. Since any incidentally caught animal would be released within the general area where caught, no change in the distribution of SA DPS green sea turtles is anticipated.

The proposed action could lethally take up to 1 SA DPS green sea turtle during consecutive 3-year periods (hopper dredging and relocation trawling, Table 20). The potential lethal take of 1 SA DPS green sea turtle during consecutive 3-year periods would reduce the number of green sea turtles, compared to their numbers in the absence of the proposed action, assuming all other variables remained the same. Lethal interactions would also result in a potential reduction in future reproduction, assuming the individual caught would be female and would have survived otherwise to reproduce. For example, as discussed in this Opinion, an adult green sea turtle can lay up to 7 clutches (usually 3-4) of eggs every 2-4 years, with up to an average of 136 eggs/nest, of which a small percentage is expected to survive to sexual maturity. The anticipated lethal interactions are expected to occur anywhere in the action area and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of green sea turtles within the SA DPS is expected from these captures.

Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends, i.e., whether the estimated reductions, when viewed within the context of the environmental baseline, status of the species, and cumulative effects are of such an extent that adverse effects on population dynamics are appreciable. In Section 4, we reviewed the status of the species in terms of nesting. Below, we synthesize what that information means in general terms and in the more specific context of the proposed action

Seminoff et al. (2015) estimated that there are greater than 63,000 nesting females in the SA DPS, though they noted the adult female nesting abundance from 37 beaches could not be quantified. The nesting at Poilão, Guinea-Bissau, accounted for approximately 46% of that estimate (approximately 30,000 nesters), with Ascension Island, United Kingdom, (approximately 13,400 nesters; 21%), and the Galibi Reserve, Suriname (approximately 9,400 nesters; 15%) also accounting for a large portion of the overall nesting (Seminoff et al. 2015).

Seminoff et al. (2015) reported that while trends cannot be estimated for many nesting populations due to the lack of data, they could discuss possible trends at some of the primary nesting sites. Seminoff et al. (2015) indicated that the nesting concentration at Ascension Island

(United Kingdom) is one of the largest in the SA DPS and the population has increased substantially over the last 3 decades (Broderick et al. 2006; Glen et al. 2006). Mortimer and Carr (1987) counted 5,257 nests in 1977 (about 1,500 females), and 10,764 nests in 1978 (about 3,000 females) whereas from 1999–2004, a total of about 3,500 females nested each year (Broderick et al. 2006). Since 1977, numbers of nests on 1 of the 2 major nesting beaches, Long Beach, have increased exponentially from around 1,000 to almost 10,000 (Seminoff et al. 2015). From 2010 to 2012, an average of 23,000 nests per year was laid on Ascension (Seminoff et al. 2015). Seminoff et al. (2015), caution that while these data are suggestive of an increase, historic data from additional years are needed to fully substantiate this possibility.

Seminoff et al. (2015) reported that the nesting concentration at Galibi Reserve and Matapica in Suriname was stable from the 1970s through the 1980s. From 1975–1979, 1,657 females were counted (Schulz 1982), a number that increased to a mean of 1,740 females from 1983–1987 (Ogren 1989), and to 1,803 females in 1995 (Weijerman et al. 1998). Since 2000, there appears to be a rapid increase in nest numbers (Seminoff et al. 2015).

In the Bijagos Archipelago (Poilão, Guinea-Bissau), Parris and Agardy (1993 as cited in Fretey 2001) reported approximately 2,000 nesting females per season from 1990 to 1992, and Catry et al. (2002) reported approximately 2,500 females nesting during the 2000 season. Given the typical large annual variability in green sea turtle nesting, Catry et al. (2009) suggested it was premature to consider there to be a positive trend in Poilão nesting, though others have made such a conclusion (Broderick et al. 2006). Despite the seeming increase in nesting, interviews along the coastal areas of Guinea-Bissau generally resulted in the view that sea turtles overall have decreased noticeably in numbers over the past two decades (Catry et al. 2009). In 2011, a record estimated 50,000 green sea turtle clutches were laid throughout the Bijagos Archipelago (Seminoff et al. 2015).

Nesting at the primary nesting beaches has been increasing over the course of the decades, against the background of the past and ongoing human and natural factors (environmental baseline) that have contributed to the current status of the species. We believe these nesting trends are indicative of a species with a high number of sexually mature individuals. Since the abundance trend information for green sea turtles is clearly increasing, we believe the potential lethal take of 1 green sea turtle from the SA DPS during consecutive 3-year periods attributed to the proposed action will not have any measurable effect on that trend. After analyzing the magnitude of the effects of the proposed action, in combination with the past, present, and future expected impacts to the DPS discussed in this Opinion, we believe the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the green sea turtle SA DPS in the wild.

Recovery

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might affect its likelihood of recovery or the rate at which recovery is expected to occur to an extent that the species' continued existence is jeopardized. NMFS has determined above, that the proposed action will not appreciably reduce the likelihood that green sea turtles (SA DPS) will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. Like the NA DPS, the SA DPS of green sea turtles does not have a separate recovery plan in place at this time. However, an Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991) does exist. Since the animals within the SA DPS all occur in the Atlantic Ocean and would have been subject to the recovery actions described in that plan, we believe it is appropriate to continue using that Recovery Plan as a guide until a new plan, specific to the SA DPS, is developed. In our analysis for the NA DPS, we stated that the Atlantic Recovery Plan lists the following relevant recovery objectives over a period of 25 continuous years:

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

Objective: A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.

The nesting recovery objective is specific to the NA DPS, but demonstrates the importance of increases in nesting to recovery. As previously stated, nesting at the primary SA DPS nesting beaches has been increasing over the course of the decades. There are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds. Given the clear increases in nesting and in-water abundance, however, it is likely that numbers on foraging grounds have increased.

The potential lethal take of up to 1 SA DPS green sea turtle during consecutive 3-year periods will result in a reduction in numbers when capture occurs, but it is unlikely to have any detectable influence on the trends noted above, even when considered in context with the Status of the Species, the Environmental Baseline, and Cumulative Effects discussed in this Opinion. Nonlethal capture of a sea turtle would not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action will not impede achieving the recovery objectives above and will not result in an appreciable reduction in the likelihood of the SA DPS of green sea turtles' recovery in the wild.

Conclusion

The lethal and nonlethal captures of green sea turtles associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the SA DPS of green sea turtle in the wild.

8.3 Kemp's Ridley Sea Turtles

The nonlethal capture of 45 Kemp's ridley sea turtles during consecutive 3-year periods is not expected to have any measurable impact on the reproduction, numbers, or distribution of this species. The individuals are expected to fully recover such that no reductions in reproduction or numbers of Kemp's ridley sea turtles are anticipated. The captures may occur anywhere in the action area and the action area encompasses a tiny portion of Kemp's ridley sea turtles' overall range/distribution. Since any incidentally caught animals would be released within the general area where caught, no change in the distribution of Kemp's ridley sea turtles is anticipated.

The lethal capture of up to 9 Kemp's ridley sea turtles (8 lethal hopper dredge interactions, and a possible additional lethal capture in a relocation trawl) during consecutive 3-year periods (Table 20) would reduce the species' population compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. The TEWG (1998a) estimates age at maturity from 7-15 years. Females return to their nesting beach about every 2 years (TEWG 1998a). The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season. Lethal captures could also result in a potential reduction in future reproduction, assuming at least some of these individuals would be female and would have survived to reproduce in the future. While we have no reason to believe the proposed action will disproportionately affect females, the loss of up 9 Kemp's ridley sea turtles during consecutive 3-year periods, could preclude the production of thousands of eggs and hatchlings, of which a small percentage is expected to survive to sexual maturity. Thus, the death of any females would eliminate their contribution to future generations, and result in a reduction in sea turtle reproduction. The anticipated captures are expected to occur anywhere in the action area and sea turtles generally have large ranges; thus, no reduction in the distribution of Kemp's ridley sea turtles is expected from the capture of these individuals.

Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends, i.e., whether the estimated reductions, when viewed within the context of the environmental baseline, status of the species, and cumulative effects are of such an extent that adverse effects on population dynamics are appreciable. In Section 4, we reviewed the status of the species in terms of estimates of nesting females and nesting trends. Below, we synthesize what that information means in general terms and in the more specific context of the proposed action.

In the absence of any total population estimates for Kemp's ridley sea turtles, nesting trends are the best proxy we have for estimating population changes. Approximately 25,000 nests would be needed for an estimate of 10,000 nesters on the beach, based on an average 2.5 nests/nesting female. In 2009, the population was on track with 21,144 nests, but an unexpected and as yet unexplained drop in nesting occurred in 2010 (loss of 13,302 nests), deviating from the NMFS et al. (2011d) model prediction. A subsequent increase to 20,570 nests occurred in 2011. In 2012, the number had increased again. Researchers documented 21,797 nests in Tamaulipas, Mexico (Burchfield 2013), and 209 nests were reported in Texas as of August 2012. The number of nests documented in Mexico declined to 16,385 again in 2013 and to 11,279 nests in 2014. In 2015, nesting in Mexico improved to 14,006 recorded nests (J. Pena, Gladys Porter Zoo, pers. comm. to M. Barnette, NMFS PRD, October 19, 2015). Based on preliminary numbers, 2016 is looking like a very good year for Kemp's nesting with around 18,000 registered nests in Mexico. This would be the 4th highest ever nesting season for Kemp's nests in Mexico. We will not know the population general trajectory until future nesting data are available. The recent increases in Kemp's ridley sea turtle nesting seen in the last two decades is likely due to a combination of management measures including elimination of direct harvest, nest protection, the use of TEDs, reduced trawling effort in Mexico and the U.S., and possibly other changes in vital rates (TEWG 1998b; TEWG 2000b). While these results are encouraging, the species' limited range as well as low global abundance makes it particularly vulnerable to new sources of mortality as well as demographic and environmental randomness, all of which are often difficult to predict with any certainty.

The nesting trend over the last 2 decades appears to be evidence of an increasing population against the background of the past and ongoing human and natural factors (environmental baseline) that have contributed to the current status of the species, although recent drops in nesting remain a source of concern. Additionally, our evaluation of potential future mortalities is based our belief that the same level of interactions occurred in the past, and with that level we have still seen positive trends in the status of this species. Thus, we believe the potential loss of up to 9 Kemp's ridley sea turtles during consecutive 3-year periods will not have any detectable effect on the population, distribution or reproduction of Kemp's ridley sea turtles. After analyzing the magnitude of the effects of the proposed action, in combination with the past, present, and future expected impacts to the species discussed in this Opinion, we believe the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the Kemp's ridley sea turtle NA DPS in the wild.

Recovery

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might affect its likelihood of recovery or the rate at which recovery is expected to occur to an extent that the species' continued existence is jeopardized. NMFS has determined above, that the proposed action will not appreciably reduce the likelihood that Kemp's ridley sea turtles will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. The Kemp's ridley recovery plan defines the recovery goal as: "…conserv[ing] and protect[ing] the Kemp's ridley sea turtle so that protections under the Endangered Species Act are no longer necessary and the species can be removed from the List of Endangered and Threatened Wildlife" (NMFS et al. 2011a). The recovery plan for the Kemp's ridley sea turtle (NMFS et al. 2011c) lists the following relevant recovery objective:

> *Objective:* A population of at least 10,000 nesting females in a season (as measured by clutch frequency per female per season) distributed at the primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) in Mexico is attained. Methodology and capacity to implement and ensure accurate nesting female counts have been developed.

With respect to this recovery objective, the preliminary nesting numbers for in 2015, indicate there were 10,351 nests in Rancho Nuevo, 890 in Tepehuajes, and 1,535 in Playa Dos, Mexico, for a total of 12,776 nests. This number represents approximately 5,110 nesting females for the season based on 2.5 clutches/female/season. The number of nests reported annually from 2010 to 2014 overall declined; however they rebounded some in 2015. Although there has been a substantial increase in the Kemp's ridley population within the last few decades, the number of nesting females is still below the number of 10,000 nesting females per season required for downlisting (NMFS and USFWS 2015). Since we concluded that the potential loss of up to 9 Kemp's ridley sea turtles during consecutive 3-year periods is not likely to have any detectable effect on nesting trends, we do not believe the proposed action will impede the progress toward achieving this recovery objective even when considered in the context of the Status of the Species, Environmental Baseline, and Cumulative Effects discussed in this Opinion. We believe the proposed action will not result in an appreciable reduction in the likelihood of Kemp's ridley sea turtles' recovery in the wild.

Conclusion
The lethal or nonlethal captures of a Kemp's ridley sea turtle associated with the proposed action is not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the Kemp's ridley sea turtle in the wild.

8.4 Leatherback Sea Turtles

Amongst sea turtles, leatherbacks are the species least likely to be adversely affected by the proposed action. As noted in the effects analysis, leatherback sea turtles are generally not vulnerable to entrainment due to their large size and preference for offshore pelagic habits. The USACE has no records of leatherback sea turtles being entrained in hopper dredge operations within the Gulf of Mexico or elsewhere (USACE Sea Turtle Data Warehouse 2013). We do not expect or authorize any lethal take of leatherback sea turtles from the proposed action. Based on the encounter data, we estimated that only 1 nonlethal take will result from this action through the relocation trawling effort.

The maximum potential nonlethal take of 1 leatherback sea turtle during relocation trawling in state waters (over consecutive 3-year periods) is not a reduction in numbers. This nonlethal take will not result in a reduction in future reproduction because these relocated leatherback sea turtles will continue to contribute to future generations. Because the anticipated nonlethal take is expected to occur anywhere in the action area, no reduction in the distribution of leatherback sea turtles is expected from the proposed action. In summary, the proposed action is not expected to result in any reduction in numbers, reproduction or distribution of leatherback sea turtles. Therefore, we believe the proposed action is not reasonably expected to cause, directly or indirectly, a reduction in the likelihood of survival or recovery of leatherback sea turtles in the wild.

8.5 Gulf Sturgeon

The nonlethal capture of 8 Gulf sturgeon during consecutive 3-year periods is not expected to have any measurable impact on the reproduction, numbers, or distribution of this species. The individuals are expected to fully recover such that no reductions in reproduction or numbers of Gulf sturgeon are anticipated. The captures may occur anywhere in the action area and the action area encompasses a tiny portion of the Gulf sturgeon's overall range/distribution. Since any incidentally caught animals would be released within the general area where caught, no change in the distribution of the Gulf sturgeon is anticipated.

The lethal capture of up to 5 Gulf sturgeon during consecutive 3-year periods (Table 20) would reduce the species' population compared to the number that would have been present in the absence of the proposed action, assuming all other variables remained the same. Gulf sturgeon are long-lived, with some individuals reaching at least 42 years in age (Huff 1975). Age at sexual maturity ranges from 8-17 years for females and 7-21 years for males (Huff 1975). Chapman and Carr (1995) estimated that mature female Gulf sturgeon weighing between 64 and 112 lb (29-51 kg) produce an average of 400,000 eggs. Spawning intervals range from 1-5 years for males, while females require longer intervals ranging from 3-5 years (Fox et al. 2000; Huff 1975). Lethal captures could also result in a potential reduction in future reproduction, assuming at least some of these individuals would be female and would have survived to reproduce in the future. While we have no reason to believe the proposed action will disproportionately affect females, the loss of up 5 Gulf sturgeon during consecutive 3-year periods, could preclude the production of thousands of eggs, of which a small percentage is expected to survive to sexual maturity. Thus, the death of any females would eliminate their contribution to future generations, and result in a reduction in Gulf sturgeon reproduction. The anticipated captures are expected to occur anywhere in the action area and Gulf sturgeon generally have large ranges; thus, no reduction in the distribution of Gulf sturgeon is expected from the capture of these individuals.

Populations in the Pearl and Pascagoula Rivers, 2 of the 7 confirmed spawning river populations, have never been nearly as abundant as those to the east, and their current status, post-Hurricanes Katrina and Rita, is unknown as comprehensive surveys have not occurred. Currently, it is estimated that there are approximately 216 spawners in the Pascagoula and 430 spawners in the Pearl. While the death of 5 Gulf sturgeon will reduce the number of Gulf sturgeon in the population compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will change the status of this population or its trend.

This small reduction in potential spawners is expected to result in a reduction in the number of eggs laid and larvae produced in future years and similarly, a small effect on the strength of subsequent year classes. However, it is unlikely that the loss of 5 Gulf sturgeon will affect the overall success of spawning due to the small number of individuals lost compared to the remainder of the population and their reproductive capacity. Additionally, the proposed action will not affect spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds.

The proposed action is not likely to reduce distribution because the action will not impede Gulf sturgeon from accessing any seasonal concentration areas, including foraging, spawning or overwintering grounds in the Gulf of Mexico.

Based on the information provided above, the death of 5 Gulf sturgeon during consecutive 3-year periods resulting from the project will not appreciably reduce the likelihood of survival of the population or of this species. The action will not affect Gulf sturgeon in a way that prevents the species from having a sufficient population, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Gulf sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter (i.e., it will not increase the risk of extinction faced by this species).

Recovery

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might affect its likelihood of recovery or the rate at which recovery is expected to occur to an extent that the species' continued existence is jeopardized. NMFS has determined above, that the proposed action will not appreciably reduce the likelihood that Gulf sturgeon will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. Recovery is defined as the improvement in status such that listing is no longer appropriate. The Gulf Sturgeon Recovery/Management Plan was created in 1995 (USFWS and GSMFC 1995). During the most recent 5-year review (USFWS and NMFS 2009), it was determined that the 1995 criteria do not directly address the 5 statutory listing/recovery factors. Five-factor-based criteria are necessary for measuring progress towards reducing threats and for determining when the protections of the Act are no longer necessary for the taxon. New criteria in a revised recovery plan should use demographic parameters that can be estimated from mark-recapture studies, including population abundance, and other appropriate metrics organized according to the statutory 5 factors. To evaluate whether the reductions in numbers and reproduction from the proposed action will appreciably reduce the Gulf sturgeons likelihood of recovery in the wild, we evaluated whether these reductions would in turn reduce the likelihood that the status of the Gulf sturgeon can improve to the point where it is recovered and could be delisted.

The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in a small reduction in the number of Gulf sturgeon in the Gulf of Mexico and therefore, it will not affect the overall distribution of Gulf sturgeon. The proposed action may result in the mortality of up to 5 Gulf sturgeon (4 by hopper dredging, and up to 1 by relocation trawling) in state waters, and the nonlethal capture of 8 Gulf sturgeon by relocation trawling during consecutive 3-year periods; however, the loss of these individuals is not expected to affect the population within the Gulf of Mexico. The reduction in numbers and future reproduction is small, therefore the loss of these individuals will not change the status of the species. The effects of the proposed action will not delay the recovery timeline or otherwise decrease the likelihood of recovery since the action will cause the mortality of a small percentage of the species as a whole and this mortality is not expected to result in the reduction of overall reproductive fitness for the species as a whole.

Conclusion

The lethal or nonlethal captures of Gulf sturgeon associated with the proposed action is not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the Gulf sturgeon in the wild.

9 DESTRUCTION OR ADVERSE MODIFICATION ANALYSIS

NMFS' regulations define *Destruction or adverse modification* to mean a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (81 FR 7214). Other alterations that may destroy or adversely modify critical habitat may include impacts to the area itself, such as those that would impede access to or use of the essential features. We intend the phrase 'significant delay' in development of essential features to encompass a delay that interrupts the likely natural trajectory of the development of physical and biological features in the designated critical habitat to support the species' recovery. NMFS will generally conclude that a Federal action is likely to "destroy or adversely modify" designated critical habitat if the action results in an alteration of the quantity or quality of the essential physical or biological features of designated critical habitat, or that precludes or significantly delays the capacity of that habitat to develop those features over time, and if the effect of the alteration is to appreciably diminish the value of critical habitat for the conservation of the species. This analysis takes into account the geographic and temporal scope of the proposed action, recognizing that "functionality" of critical habitat necessarily means that it must now and must continue in the future to support the conservation of the species and progress toward recovery. Destruction or adverse modification does not depend strictly on the size or proportion of the area adversely affected, but rather on the role the action area serves with regard to the function of the overall designation, and how that role is affected by the action.

This section analyzes the effects of this action relative to the ecological function of the PBFs of designated critical habitat within Unit 8 continuing to provide subadult and adult feeding, sediment quality, and water quality habitat for recovering populations of Gulf sturgeon from the Pearl and Pascagoula Rivers (68 FR 13395) sub-populations, as well as the sub-populations that have been observed utilizing Unit 8 from the east such as the Blackwater, Choctawhatchee, Yellow, and Escambia River subpopulations (ERDC 2012). In the following analysis, we demonstrate that while filling of the Port of Gulfport Expansion footprint, placement of a breakwater along the eastern edge of the Gulfport navigational channel, and periodic future maintenance dredging events will both permanently and temporarily adversely affect prey abundance, sediment quality, and water quality, Unit 8 will continue to serve its intended conservation role for Gulf sturgeon.

The project will permanently impact 197 ac of unvegetated substrate that supports benthic invertebrates. However, the area to be impacted by fill activities is adjacent to an active commercial shipping port with its associated physical disturbance and noise. The Port expansion would result in the filling of 197 acres of sand/mud bottom (to create uplands) that could contain infaunal prey that Gulf sturgeon might feed on. Yet, Gulf sturgeon do not appear to use the potentially-impacted areas of the Port as feeding grounds, possibly because density levels of prey species are not high enough to induce feeding by sturgeon, which seem to select areas with relatively high densities of their preferred prey species to feed in (Fox et al. 2000). These lower prey densities may be due to the degradation of the bottom sediments during the construction of the original Port (Peterson et al. 2013). Therefore, although the project will remove prey abundance in areas designated for fill when they are converted to uplands or a breakwater, these particular prey items do not appear to be fed upon by Gulf sturgeon. NMFS believes that the loss of potential foraging habitat will be small (less than 0.02% of the area within Unit 8) compared to the total acreage found within Unit 8 of GSCH and will not affect the overall function of GSCH conservation and recovery ability. While habitat known to support prey will be both permanently and temporarily impacted, it is likely that any Gulf sturgeon in the project area have the ability to find appropriate and abundant prey in the areas adjacent to the project location, as many other nearby similar prey-rich sandy areas exist. As discussed above, Gulf sturgeon are opportunistic feeders that forage over large distances, and thus will be able to locate prey throughout adjacent sandy areas in Unit 8.

The thin-layer placement of maintenance dredge material at the open-water sites to the west of the FNC will temporarily reduce prey abundance in Unit 8 of GSCH, but infaunal prey will quickly recolonize the thin-layer placement areas or burrow up to the surface through the maximum of 12 inches of dredge material following placement. The temporary decrease of prey abundance in these areas is not expected to reduce the ability of Unit 8 to function and support the recovery of Gulf sturgeon. Therefore, while the temporary loss of prey in maintenance dredged areas and the permanent loss of 197 ac of habitat containing Gulf sturgeon prey will adversely affect the prey abundance PBF, it will not destroy or adversely modify GSCH. The conservation function of Unit 8 will remain intact.

While 197 ac of the sediment quality PBF (and its associated textural and chemical characteristics) will be permanently lost due to the project's fill activities, these benthic areas do not appear to be used by Gulf sturgeon (e.g., for feeding or resting). The affected sites seem to be used primarily as areas that Gulf sturgeon pass through when transiting between rivers and nearshore feeding areas around barrier islands and passes. Therefore, these sediments do not currently support the desired conservation role for Gulf sturgeon. However, ample similar habitat, which is likely currently serving the conservation function for the species, is available in the surrounding area. As Gulf sturgeon regularly migrate over large areas and can easily access surrounding habitat, the loss of this small area should not appreciably alter the conservation function of the overall critical habitat in the area.

The dredging and thin-layer placement of maintenance dredge material at the open-water sites to the west of the FNC in single 6- to 12-inch lifts over the surface area will not affect the sediment quality PBF as the dredge material will be similar in composition to the sediments presently at those sites.

Therefore, while the permanent loss of 197 acres of submerged sediment will adversely affect the sediment quality PBF, it will not destroy or adversely modify GSCH. The conservation function of Unit 8 will remain intact.

In addition, the water quality PBF (water column) that overlies the 197 ac fill impact area will be permanently lost due to the project's fill activities. These areas do not appear to support important foraging areas, such as those near barrier islands and passes, and sturgeon will be able to transit around the fill areas when migrating between rivers and nearshore feeding areas (as they have been doing since the original Port was constructed). NMFS believes that the loss of water quality PBF will be small (less than 0.02% of area within Unit 8) compared to the total area found within Unit 8 of GSCH, where similar habitat with sufficient water quality exists, and will not affect the overall function of GSCH conservation and recovery ability.

The dredging and placement of material associated with dredging will create some degree of turbidity in excess of the natural conditions. Water quality impacts from turbidity as a result of dredging and material placement are expected to be temporary and localized, with suspended particles settling out within a short time frame without measurable effects on water quality. In addition, Mississippi Sound is a naturally turbid waterbody (especially during periods of high winds, currents, and waves) to which animals occurring there are adapted. The water column's dissolved oxygen levels may be temporarily lowered during dredge and fill operations, but this impact will also be temporary and localized with dissolved oxygen returning to ambient levels within a short time.

Therefore, while the permanent loss of water column overlying the 197 acres of submerged sediment and temporary alteration of water quality during dredge and fill operations will adversely affect the water quality PBF, it will not destroy or adversely modify GSCH. The conservation function of Unit 8 will remain intact.

Finally, the proposed action will not interfere with recovery objectives, actions, or tasks identified in the Gulf sturgeon recovery plan (USFWS and GSMFC 1995). The proposed action will not affect population size or distribution, disrupt research activities, and will not impede recovery of the species. NMFS concludes that the effects of the project will not discernibly impact the ecological function of Unit 8, and that it will continue to serve its intended conservation role for Gulf sturgeon.

10 CONCLUSION

Green, Kemp's Ridley, Leatherback, and Loggerhead Sea Turtles, and Gulf Sturgeon

Using the best available data, we analyzed the effects of the proposed action in the context of the status of the species, the environmental baseline, and cumulative effects, and determined that the proposed action is not likely to appreciably reduce the likelihood of survival and recovery of green (NA or SA DPS), Kemp's ridley, leatherback, or the NWA DPS of loggerhead sea turtles or Gulf sturgeon. Therefore, it is our Opinion that the action is not likely to jeopardize their continued existence.

Gulf Sturgeon Critical Habitat

After reviewing the current status of GSCH in Unit 8, the environmental baseline, the effects of the proposed action, and the cumulative effects, it is NMFS's Biological Opinion that the dredging and placement of material associated with the project will not reduce the critical habitat's ability to support the Gulf sturgeon's conservation. NMFS does not expect the adverse impacts to prey abundance, sediment quality, and water quality resulting from this proposed action to appreciably reduce the conservation function of GSCH. NMFS concludes the action, as proposed, is not likely to destroy or adversely modify designated GSCH.

11 INCIDENTAL TAKE STATEMENT

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. 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 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.

11.1 Anticipated Amount or Extent of Incidental Take

Based on historical distribution data, hopper dredge observer reports, relocation trawling data, observations of past strandings, and increasing turtle populations of green, Kemp's ridley, and loggerhead sea turtles in the action area, we estimate that these species may occur in the action area and may be taken by the hopper dredging operations of this project (by crushing and/or entrainment in suction dragheads), or by relocation trawling. Note that for loggerhead, Kemp's ridley, and green sea turtles, and Gulf sturgeon, the authorized lethal take for hopper dredges is half the anticipated total take (including observed and unobserved take) because NMFS estimates that only half of the total takes will be observed and documented by onboard observers. Therefore, authorized lethal take levels are based only on those takes that will be observed with the assumption that half of the actual lethal takes will go unobserved.

NMFS anticipates observed lethal incidental take will consist of up to 9 sea turtles (consisting of up to 4 Kemp's ridley, 3 loggerhead, and 1 green sea turtle by hopper dredging, and 1 additional sea turtle that may be from any of the three species by relocation trawling), and 3 Gulf sturgeon (2 by hopper dredging and 1 by relocation trawling) during consecutive 3-year periods (Table

21). NMFS also anticipates that relocation trawling may result in up to 85 non-injurious captures and relocations per consecutive 3-year periods of an estimated 29 loggerhead, 45 Kemp's ridley, 2 green, and 1 leatherback sea turtles, and 8 Gulf sturgeon.

Table 21. Amount of Authorized Observed Take during the Port of Gulfport Expansion Project and Associated Relocation Trawling per Consecutive 3-year Periods

During Dredging	Loggerhead	Kemp's ridley	Green	Leatherback	Gulf sturgeon
Total Species Lethally Taken	3	4	1	0	2
During Relocation Trawling					
Total Species Nonlethally Taken	29	45	2	1	8
Total Species Lethally Taken	1[18]	1[19]	1[20]	0	1[21]

11.2 Effect of the Take

NMFS has determined the anticipated level of incidental take specified in Section 11.1 is not likely to jeopardize the continued existence of loggerhead (NWA DPS), Kemp's ridley, green (NA or SA DPS), or leatherback sea turtles or Gulf sturgeon.

11.3 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 402.14(i), to document the incidental take of ESA-listed species by the proposed action, to minimize the impact of that take, and to specify the procedures to be used to handle any individuals taken. These measures and terms and conditions are non-discretionary and must be implemented by the USACE and/or the applicant in order for the protection of Section 7(o)(2) to apply. The USACE has a continuing duty to regulate the activity covered by this ITS. If the USACE and/or the applicant 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.

Current Regional Opinions for hopper dredging require observers to document takes, use deflector dragheads, and follow conditions and guidelines for relocation trawling, which NMFS believes are necessary to minimize the effects of dredging activities on listed sea turtle species that occur in the action area. NMFS has determined that the following RPMs, patterned after long-standing hopper dredging requirements, are necessary and appropriate to minimize impacts

[18] NMFS believes that 1 sea turtle will be captured lethally during consecutive 3-year periods. NMFS estimates that the lethal trawling interaction will most likely consist of a Kemp's ridley sea turtle, the most common species in the action area, but it is possible that the single turtle could be either a loggerhead or green sea turtle.
[19] *Ibid*.
[20] *Ibid*.
[21] The potential lethal take of 1 Gulf sturgeon during relocation trawling is considered part of the potential 8 nonlethal takes and is not in addition to those 8 takes.

of the incidental take of sea turtles during the proposed action. The RPMs that NMFS believes are necessary to minimize and monitor the impacts of the proposed hopper dredging have been discussed with the USACE in the past and are standard operating procedures, including use of sea turtle deflector dragheads, use of dredged material inflow and overflow screening, observer and reporting requirements, and relocation trawling. The following RPMs and associated terms and conditions are established to implement these measures, to document incidental takes, and to specify procedures for handling individuals taken. Only incidental takes that occur while these measures are in full implementation are authorized.

1. The USACE and/or the applicant will implement best management measures, including use of temperature- and date-based dredging windows, sea turtle deflector dragheads, disengagement of dredging pumps when they are not on the bottom, limiting dredge lights seasonally, and relocation trawling to reduce the risk of injury or mortality of listed species and lessen the number of sea turtles killed by the proposed action.

   Rationale: Temperature- and date-based dredging windows appear to be very effective in reducing sea turtle entrainments, by avoiding times and places either where turtle densities are high or their behaviors may make them less susceptible to entrainment. Draghead deflectors provide a last line of defense, by acting as physical barriers, reducing the likelihood that turtles that are close to the draghead are actually entrained. When the suction dragheads are not firmly placed on the bottom during dredging operations, sea turtles encountered by the dragheads can be crushed underneath them and/or impinged or sucked into the suction pipes by the powerful suction, almost always resulting in death. Seasonally limiting dredge lights will help reduce potential disorientation effects on female sea turtles approaching the nesting beaches and sea turtle hatchlings making their way seaward from their natal beaches. Relocation (i.e., capture) trawling reduces the risk of turtle entrainment even when turtle densities are high, possibly by either temporarily reducing the local density of turtles in the channel where the dredge is working or by modifying the turtles' behavior temporarily and making them less susceptible to entrainment. In addition, the use of relocation trawling provides the USACE with valuable real-time estimates of sea turtle abundance, takes, and distribution which have been helpful to USACE project planning efforts to reduce sea turtle impacts, for example by delaying or changing the location of hopper dredge deployment in response to sea turtle density information in the channel.

2. The USACE and/or the applicant shall have measures in place to detect and report all interactions with any protected species (ESA or MMPA) resulting from the proposed action. These measures include endangered species observers aboard the hopper dredge and relocation trawlers, screening of dredged material to allow discovery of any entrained turtles and sturgeon, and handling procedures for incidentally taken animals.

   Rationale: NMFS-approved observers monitor dredged material inflow and overflow screening baskets and relocation trawling efforts to monitor and report incidental take. Gathering basic biological information (e.g., size which will help determine the age class) will enable monitoring of the impact of the take on the species taken. PIT tagging, external flipper tagging, and tissue sampling of turtles and Gulf sturgeon captured pursuant to relocation trawling, including genetic analysis of tissue samples taken from dredge- and trawl-captured turtles, will provide important monitoring information about the animals taken during relocation trawling. Tagging will inform about the fate of the turtles and Gulf sturgeon relocated should they be recaptured or strand subsequent to being relocated. Tissue sampling will identify which sea turtle and Gulf sturgeon stocks are being impacted and their geographic origin.

11.4 Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, the USACE and/or the applicant must comply with the following terms and conditions, which implement the RPMs described above and outline required reporting and monitoring requirements. These terms and conditions are non-discretionary.

1) Hopper Dredging (RPM 1): Hopper dredging activities shall be completed, whenever possible, between December 1 and March 31, when sea turtle abundance is lowest throughout Gulf coastal waters.
2) Non-hopper Type Dredging (RPM 1): Pipeline or hydraulic dredges, because they are not known to take healthy sea turtles and have not taken Gulf sturgeon, must be used whenever possible between April 1 and November 30.
3) Operational Procedures (RPM 1): During periods in which hopper dredges are operating and NMFS-approved protected species observers are *not* required, (December 1 through March 31, if water temperatures are under 11°C), the USACE and/or the applicant must:
    a) Advise inspectors, operators, and vessel captains about the prohibitions on taking, harming, or harassing sea turtles
    b) Instruct the captain of the hopper dredge to avoid any turtles encountered while traveling between the dredge site and offshore disposal area, and to immediately contact the USACE and/or the applicant if sea turtles are seen in the vicinity
    c) Notify NMFS immediately by email (takereport.nmfsser@noaa.gov) if a sea turtle or other threatened or endangered species is taken by the dredge, and reference this Biological Opinion (SER-2015-17454)
4) Dredging Pumps (RPM 1): Standard operating procedure shall be that dredging pumps shall be disengaged by the operator when the dragheads are not firmly on the bottom, to prevent impingement or entrainment of sea turtles within the water column. This precaution is especially important during the cleanup phase of dredging operations when the draghead frequently comes off the bottom and can suck in turtles resting in the shallow depressions between the high spots the draghead is trimming off.
5) Dredge Lighting (RPM 1): From May 1 through October 31, sea turtle nesting and emergence season, all lighting aboard hopper dredges and hopper dredge pumpout barges operating within 3 nmi of sea turtle nesting beaches shall be limited to the minimal lighting necessary to comply with USCG and/or Occupational Safety and Health Administration requirements. All non-essential lighting on the dredge and pumpout barge shall be minimized through reduction, shielding, lowering, and appropriate placement of lights to minimize illumination of the water to reduce potential disorientation effects on female sea

turtles approaching the nesting beaches and sea turtle hatchlings making their way seaward from their natal beaches.

6) Sea Turtle Deflecting Draghead (RPM 1): State-of-the-art, solid, plow-type rigid deflector dragheads must be used on all hopper dredges at all times. The use of alternative, experimental dragheads is not authorized without prior written approval from NMFS, in consultation with USACE ERDC. Slotted draghead deflectors or chain-type deflectors are currently not authorized.

7) Training – Personnel on Hopper Dredges (RPM 1): The USACE and/or the applicant must ensure that all contracted personnel involved in operating hopper dredges receive thorough training on measures of dredge operation that will minimize takes of sea turtles. It shall be the goal of the hopper dredging operation to establish operating procedures that are consistent with those that have been used successfully during hopper dredging in other regions of the coastal United States, and which have proven effective in reducing turtle/dredge interactions. Therefore, USACE ERDC experts or other persons with expertise in this matter shall be involved both in dredge operation training, and installation, adjustment, and monitoring of the rigid deflector draghead assembly.

8) Observers (RPM 2): The USACE and/or the applicant shall arrange for NMFS-approved protected species observers to be aboard the hopper dredges to monitor the hopper bin, screening, and dragheads for sea turtles and their remains. Observer coverage sufficient for 100% monitoring (i.e., 2 observers) of hopper dredging operations is required aboard the hopper dredges between April 1 and November 30, or whenever surface water temperatures are 11°C or greater.

9) Screening (RPM 2): When sea turtle observers are required on hopper dredges, 100% inflow screening of dredged material is required and 100% overflow screening is recommended. If conditions prevent 100% inflow screening, inflow screening may be reduced gradually, as further detailed in the following, but 100% overflow screening is then required.

   a) Screen Size: The hopper's inflow screens should have 4-in by 4-in screening. If the USACE and/or the applicant, in consultation with observers and the draghead operator, determines that the draghead is clogging and reducing production substantially, other than in sand borrow areas the screens may be modified sequentially. Mesh size may be increased to 8-in by 8-in; if that fails to solve the clogging problem, then 16-in by 16-in openings may be used. Clogging should be greatly reduced or eliminated with these options; however, further clogging may compel removal of the screening altogether, in which case effective 100% overflow monitoring and screening is mandatory. The USACE and/or the applicant shall notify NMFS beforehand if inflow screening is going to be reduced or eliminated, what attempts were made to reduce the clogging problem, and provide details of how effective overflow screening will be achieved.

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

10) Dredge Take Reporting and Final Report (RPM 2): Observer reports of incidental take by hopper dredges must be emailed to the Southeast Regional Office (takereport.nmfsser@noaa.gov) with reference to this Biological Opinion (SER-2015-17454) by onboard NMFS-approved protected species observers, the dredging company, the USACE and/or the applicant within 24-hours of any sea turtle, Gulf sturgeon, or other listed species take observed.

    A final report summarizing the results of the hopper dredging and any documented sea turtle, Gulf sturgeon, or other listed species takes must be submitted to NMFS (takereport.nmfsser@noaa.gov) with reference to this Biological Opinion (SER-2015-17454) within 60 working days of completion of the dredging project. The reports shall contain information on project location (specific channel/area dredged), start-up and completion dates, cubic yards of material dredged, problems encountered, incidental takes and sightings of protected species, mitigative actions taken (if relocation trawling, the number and species of turtles relocated), screening type (inflow, overflow) utilized, daily water temperatures, name of dredge, names of endangered species observers, percent observer coverage, and any other information the USACE and/or the applicant deems relevant.

11) Sea Turtle Strandings (RPM 2): The USACE Project Manager or designated representative shall notify the STSSN state representative (contact information available at: http://www.sefsc.noaa.gov/species/turtles/strandings.htm) of the start-up and completion of hopper dredging operations and bed-leveler dredging operations and ask to be notified of any sea turtle strandings in the project area that, in the estimation of STSSN personnel, bear signs of potential draghead impingement or entrainment, or interaction with a bed-leveling type dredge.

    a) Information on any such strandings shall be reported in writing within 30 days of project end to NMFS's Southeast Regional Office (takereport.nmfsser@noaa.gov) with reference to this Biological Opinion (SER-2015-17454) with a report detailing incidents, with photographs when available, of stranded sea turtles that bear indications of draghead impingement or entrainment. Because the deaths of these turtles, if hopper dredge related, have already been accounted for in NMFS's jeopardy analysis as turtles not observed being taken during hopper dredging operations, these strandings will not be counted against the USACE's take limit if they do not exceed the take limits set forth in this consultation.

12) Conditions Requiring Relocation Trawling (RPM 1): The USACE and/or the applicant shall require trawling to start as soon as possible within 72 hours of either:

    a) Two or more turtles are taken by hopper dredges in a 24-hour period, or

    b) Total dredge takes in the project approach 75% (rounded-down) of any of the incidental take limits (Table 20); i.e., 1 Kemp's ridley, 1 loggerhead, or 1 green taken.

    Relocation trawling may be suspended if no relocation or dredge takes occur within 14 days.

13) Relocation Trawling (RPM 1): Any relocation trawling conducted or contracted by the USACE and/or the applicant to temporarily reduce abundance of these listed species during hopper dredging in order to reduce the possibility of lethal hopper dredge interactions, is subject to the following conditions:

a) Trawl Time: Trawl tow-time duration shall not exceed 42 minutes (measured from the time the trawl doors enter the water until the time the trawl doors are out of the water) and trawl speeds shall not exceed 3.5 knots.

   i) Protected Species Handling During Trawling: Handling of sea turtles and Gulf sturgeon captured during relocation trawling in association with the dredging project shall be conducted by NMFS-approved protected species observers. Sea turtles and Gulf sturgeon captured pursuant to relocation trawling shall be handled in a manner designed to ensure their safety and viability, and shall be released over the side of the vessel, away from the propeller, and only after ensuring that the vessel's propeller is in the neutral, or disengaged, position (i.e., not rotating). Sea turtle resuscitation must be performed in accordance with the protocol detailed in NMFS's Southeast Fisheries Science Center's (SEFSC) Sea Turtle Research Techniques Manual (See Appendix A - Sea Turtle Research Techniques Manual; Chapter 3 – Resuscitation) (SEFSC 2008). A copy can be found at: http://www.sefsc.noaa.gov/turtles/TM_579_SEFSC_STRTM.pdf .

      Other training can be found at SEFSC's Sea Turtle and Fisheries Observers webpage: http://www.sefsc.noaa.gov/species/turtles/observers.htm.

b) Any handling of Gulf sturgeon captured in the relocation trawling will comply with the NMFS's *Protocol for Use of Shortnose, Atlantic, Gulf, and Green Sturgeons* (Appendix B) (Kahn and Mohead 2010).
   A copy can be found at:
   http://www.nmfs.noaa.gov/pr/pdfs/species/kahn_mohead_2010.pdf.

c) Captured Sea Turtle Holding Conditions: Sea turtles may be held briefly for the collection of important biological information, prior to their release. Captured sea turtles shall be kept moist, and shaded whenever possible, until they are released, according to the requirements of Term and Condition No. 13-e, below.

d) Biological Data Collection: When safely possible, all sea turtles and Gulf sturgeon shall be measured, tagged, weighed, and a tissue sample taken prior to release. When handling Gulf sturgeon, NMFS's *Protocol for Use of Shortnose, Atlantic, Gulf, and Green Sturgeons* (Appendix B) (Kahn and Mohead 2010) will be used. Any external tags shall be noted and data recorded into the observers' log. Gulf sturgeon data will also be recorded on the Gulf Sturgeon Catch Datasheet & Gulf Sturgeon Survey Effort Datasheet (Appendix C). Only NMFS-approved protected species observers or observer candidates in training under the direct supervision of a NMFS-approved protected species observer shall conduct the tagging/measuring/weighing/tissues sampling operations. All Gulf sturgeon data will be submitted to Dr. Brian Kreiser, Department of Biological Sciences, 118 College Drive Ste. 5018, University of Southern Mississippi, Hattiesburg, Mississippi, 39406, Phone: (601) 266-6556.

e) Take and Release Time During Trawling – Turtles: Turtles shall be kept no longer than 12 hours prior to release and shall be released not less than 3 nmi from the dredge site. Turtles to which satellite tags will be affixed may be held up to 24 hours before release. If 2 or more released turtles are later recaptured, subsequent turtle captures shall be released not less than 5 nmi away. If it can be done safely, turtles may be transferred onto another vessel for transport to the release area to enable the relocation trawler to keep sweeping the dredge site without interruption.

f) Injuries: Injured sea turtles shall be immediately transported to the nearest sea turtle rehabilitation facility. Minor skin abrasions resulting from trawl capture are considered non-injurious. The USACE and/or the applicant shall ensure that logistical arrangements and support to accomplish this are pre-planned and ready. The USACE and/or the applicant shall bear the financial cost of all sea turtle transport, treatment, rehabilitation, and release.

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 protected species observer aboard these relocation trawlers to flipper-tag with external tags (e.g., Inconel tags) captured sea turtles. Columbus crabs or other organisms living on external sea turtle surfaces may also be sampled and removed under this Opinion's authority.

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

    i) Sea turtle PIT tagging must then be performed in accordance with the protocol detailed in NMFS's *Southeast Fisheries Science Center's Sea Turtle Research Techniques Manual* (See Appendix A - Sea Turtle Research Techniques Manual; Chapter 6 – Marking) (SEFSC 2008).

       A copy can be found at: http://www.sefsc.noaa.gov/turtles/TM_579_SEFSC_STRTM.pdf.

       Other training can be found at SEFSC's Sea Turtle and Fisheries Observers webpage: http://www.sefsc.noaa.gov/species/turtles/observers.htm.

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

    iii) All Gulf sturgeon handled shall be scanned for a PIT tag; codes shall be included in the take report submitted to NMFS. The PIT tag reader shall be able to read both 125 kHz and 134 kHz tags. Sturgeon without PIT tags will have one installed per guidance in Appendix B. Previously PIT-tagged fish must not be re-tagged.

    iv) All unmarked Gulf sturgeon less than 300 mm in total length would be tagged using 11.9 mm x 2.1 mm PIT tags injected using a 12-gauge needle at an angle of 60º to 80º in the dorsal musculature (left and just anterior to the dorsal fin) with the copper antenna oriented up for maximum signal strength. No fish would be double-tagged with PIT tags. The last step after injecting PIT tags would be to verify and record the PIT tag code with a tag reader. PIT tags may also be inserted under scutes after discussing with NMFS.

i) Sea Turtle PIT-Tag Scanning and Data Submission Requirements: All sea turtles captured by relocation trawling or dredges shall be thoroughly scanned for the presence of PIT tags prior to release using a multi-frequency scanner powerful enough to read multiple frequencies (including 125-, 128-, 134-, and 400-kHz tags) and read tags deeply embedded in muscle tissue (e.g., manufactured by Trovan, Biomark, or Avid). Turtles whose scans show they have been previously PIT tagged shall nevertheless be externally flipper tagged. Sea turtle data collected (PIT tag scan data and external tagging data) shall be submitted to NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida, 33149. All sea turtle data collected shall be submitted in electronic format within 60 days of project completion to Lisa.Belskis@noaa.gov. Sea turtle external flipper tag and PIT tag data generated and collected by relocation trawlers shall also be submitted to the Cooperative Marine Turtle Tagging Program (CMTTP), on the appropriate CMTTP form, at the University of Florida's Archie Carr Center for Sea Turtle Research.

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

k) Additional Data Collection Allowed During the Handling of Sea Turtles, Gulf sturgeon, and Other Incidentally Caught ESA-listed Species: The USACE and/or the applicant shall allow NMFS-approved protected species observers to conduct additional investigations that may include more invasive procedures (e.g., blood-letting, laparoscopies, external tumor removals, anal and gastric lavages, mounting satellite or radio transmitters) and partake in or assist in research projects but only if: (1) the additional work does not interfere with any project operations (dredging activities, relocation trawling, etc.), (2) the observer holds a valid federal research permit (and any required state permits) authorizing the activities, either as the permit holder, or as designated agent of the permit holder, (3) the additional work does not incur any additional expenses to the USACE and/or the applicant or the USACE and/or the applicant approves of the expense, and (4) the observer has first coordinated with USACE Mobile District and notified NMFS's Southeast Regional Office, Protected Resources Division (takereport.nmfsser@noaa.gov) with reference to this Biological Opinion (SER-2015-17454).

14) Relocation Trawling Report (RPM 2): The USACE and/or the applicant shall provide NMFS's Southeast Regional Office (takereport.nmfsser@noaa.gov) with reference to this Biological Opinion (SER-2015-17454) with an end-of-project report within 30 days of completion of any relocation trawling. This report may be incorporated into the final report summarizing the results of the hopper dredging project.

15) Requirement and Authority to Conduct Tissue Sampling for Genetic Analyses (RPM 2): All live or dead sea turtles and/or Gulf sturgeon captured by relocation trawling and hopper dredging shall be tissue-sampled by a NMFS-approved protected species observer prior to release. This Opinion serves as the permitting authority for any NMFS-approved protected species observer aboard a relocation trawler or hopper dredge to tissue-sample live- or dead-captured sea turtles and/or Gulf sturgeon without the need for an ESA Section 10 permit.

  a) Sea turtle tissue samples for genetic studies must be performed in accordance with the protocol detailed in NMFS's *Southeast Fisheries Science Center's Sea Turtle Research Techniques Manual* (See Appendix A - Sea Turtle Research Techniques Manual; Chapter 8 – Biopsy Sampling) (SEFSC 2008). The USACE and/or the applicant shall ensure that tissue samples taken during the dredging project are collected, stored properly, and mailed no later than 60 days of completion of the dredging project to: NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida, 33149.

  b) Gulf sturgeon tissue samples shall be taken in accordance with NMFS's *Protocol for Use of Shortnose, Atlantic, Gulf, and Green Sturgeons* (Appendix B) (Kahn and Mohead 2010). Care must be used when collecting genetic tissue samples (soft fin clips). Instruments should be changed or disinfected and gloves changed between each fish sampled to avoid possible disease transmission or cross contamination of genetic material.

    i) Submission of genetic tissue samples must be coordinated with Dr. Brian Kreiser, Department of Biological Sciences, 118 College Drive Ste. 5018, University of Southern Mississippi, Hattiesburg, Mississippi, 39406, Phone: (601) 266-6556. Additional questions will be directed to Jason Rueter, the NMFS PRD Species Coordinator for Gulf sturgeon, (727) 824-5350. Samples must be submitted within 6 months after collection.

12 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, to help implement recovery plans, or to develop information. NMFS believes that USACE and/or the applicant should implement the following conservation recommendations:

1. Gather data describing recovery rates of specific Gulf sturgeon prey impacted by the cyclical deposition of material into the adjacent disposal areas that would assist in future assessments of impacts to Gulf sturgeon prey items.

2. Gather additional data describing presence and movement of juvenile Gulf sturgeon within Mississippi Sound and the inland rivers and bays.

3. Gather data on pile-driving noise (all types – concrete, wood, steal) in Gulf of Mexico projects, to determine noise levels produced in substrate southern U.S. projects.

4. Gather data describing Gulf sturgeon movement within the Pearl River, Pascagoula River, and Mississippi Sound.

5. Provide mitigation to offset conversion of 197 acres of GSCH to upland.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

13 REINITIATION OF CONSULTATION

This concludes formal consultation on the Port of Gulfport Expansion Project, Mississippi Sound, Harrison County, Mississippi. 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 ITS is exceeded within a consecutive 3-year period;
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. In instances where the amount or extent of take is exceeded, USACE must immediately request reinitiation of formal consultation.

Dredging/Trawling Operations During Reinitiation of Consultation:
To ensure that the specified levels of take are not exceeded early in the project the USACE should immediately reinitiate consultation with NMFS's Southeast Regional Office, Protected Resources Division, if any of the following conditions are met: 2 or more turtles are taken in a 24-hour period in the project; or total dredge takes in the project approach 75% (rounded-down) of any of the incidental take limits (Table 21); a hawksbill turtle is taken by a dredge; if more than 1 turtle or 1 Gulf sturgeon is injuriously or lethally taken by a relocation trawler; or the relocation trawling incidental take limit for nonlethally taken turtles or sturgeon is reached. The NMFS's Southeast Regional Office will work with the action agencies to quickly review such incidents to determine the need to implement further mitigating measures or to terminate the remaining dredging activity. Still, the affected action agency is not required to suspend dredging or relocation trawling operations during the notification or consultation process, as long as NMFS concurs with the affected action agencies determination that continuation of operations during the reinitiated consultation will not violate Section 7(d) of the ESA.

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Appendix A - Sea Turtle Resuscitation Guidelines

Sea Turtle Resuscitation Guidelines

If a turtle appears to be unresponsive or comatose, attempt to revive it before release. Turtles can withstand lengthy periods without breathing; a comatose sea turtle will not move, breathe voluntarily, or show reflex responses or other signs of life. In other cases, an unresponsive turtle may show shallow breathing or reflexes such as eyelid or tail movement when touched. Use the following method of resuscitation in the field if veterinary attention is not immediately available:

- **Place the turtle on its plastron (lower shell) and elevate the hindquarters approximately 15 - 30 degrees to permit the lungs to drain off water for a period of 4 up to 24 hours. A board, tire or boat cushion, etc. can be used for elevation.**

- **Keep the turtle in the shade, at a temperature similar to water temperature at capture. Keep the skin (especially the eyes) moist while the turtle is on deck by covering the animal's body with a wet towel, periodically spraying it with water, or by applying petroleum jelly to its skin and carapace. Do not put the turtle into a container with water.**

- **Do not put the turtle on its carapace (top shell) and pump the plastron (breastplate) or try to compress the turtle to force water out, as this is dangerous to the turtle and may do more harm than good.**

- **Periodically, gently touch the corner of the eye or eyelid and pinch the tail near the vent (reflex tests) to monitor consciousness.**

- **Sea turtles may take some time to revive; do not give up too quickly. Turtles that are successfully resuscitated benefit from being held on deck as long as possible (up to 24 hours) to fully recover from the stress of accidental forced submergence.**

- **Release successfully resuscitated turtles over the stern of the boat, when fishing or scientific collection gear is not in use, the engine is in neutral, and in areas where they are unlikely to be recaptured or injured by vessels. A turtle that has shown no sign of life after 24 hours on deck may be considered dead and returned to the water in the same manner.**

NMFS/SEFSC Photos

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October 2008

Appendix B – Gulf Sturgeon Sampling Protocol and Monitoring

Gulf Sturgeon Sampling Protocol and Monitoring

Standardized Sampling

1. Nets - net attributes need to be recorded on data sheets: twine, mesh, hanging ratio, length. a. For capture and monitoring of adult Gulf sturgeon, nets should be 4-12 inch stretch.
b. To capture juvenile Gulf sturgeon, nets are generally 2-6 inch stretch.

2. Soak time - A 2 hour maximum soak time for anchored nets is common. All nets are to be manned.
3. Morphometric and Environmental Data to record: a. Fish - Total Length (TL) and Fork Length (FL), and weight in metric units i. Length measurements should be taken at a straight line off the body when the fish is on its side.

b. Environmental - Record at benthos when possible (or at 3 m from surface) water temperature, salinity, DO, conductivity, pH, GPS coordinates in decimal degrees at location where net is placed.
c. Genetics sample - All samples should be collected, catalogued, and sent to Dr. Brian Kreiser, University of Southern Mississippi.
d. Date.
e. Time: start time of net fishing and end time.

4. PIT tags and Readers: a. PIT tags - we will standardize to 134.2 kHz tags (12.5 mm x 2.07mm). All fish handled will be re-tagged with a new 134.2 PIT tag. PIT tags will be placed in the soft tissue at the base of the dorsal fin on either side of fish.
b. A Power Tracker V or VIII will be standard reader.

5. Discretionary for each researcher, but recommended to reduce the stress of handling a recaptured fish, is the use of T-bar tags. T-bar tags should be placed in the pectorals. Tag color and full number (including leading zeros) will be indicated on data sheet. T-Bar tags will be replaced as they are sloughed off or become fouled. Fish that are Age-1 or less do not need to have T-bar tags inserted.

Monitoring

1. Acoustic tags and receivers: VEMCO tags and receivers are to be used. a. Tags - V16 6H tags will be used. At 90 second intervals these tags should last 6.4 years. Smaller tags (e.g., VEMCO VR-7) may be used for young-of-year and juvenile fish. These tags are expected to last 305 - 426 days.
b. VR2W receivers will be used.
c. Tags will be inserted internally via surgery into the gastric cavity.

2. Receivers are to be downloaded at least once per quarter.

Appendix C - Gulf Sturgeon Catch Datasheet and Gulf Sturgeon Survey Effort Datasheet

Gulf Sturgeon Survey
Effort Datasheet

Effort **Page_____ of _____**

DATE _______________ RESEARCHER __________________ SET # ____________

BAY, RIVER, OR MARINE? ________________ LOCATION NAME abbr (see key for names) __________________

LATITUDE (dd.mmsss)_______________ LONGITUDE (dd.mmsss)_________________

SURVEY TYPE __________________ (Outmigration, juvenile, summer, winter, non-random, spring)

GEAR SET TIME (military time, first part of gear in water) ___________ SET END TIME ___________

GEAR TYPE abbr _____________ GEAR = Drift Gillnett=DG, Anchored Gillnet=AG, Commercial Gillnet=CG, Survey Trawl=ST, Commercial Trawl=CT, Recreational hook and line=HL

IF GEAR=ST:
UPPER PANL MESH SIZE(S) (cm)____________ COD END MESH SIZE ________
NET LENGTH (m) __________ MOUTH WIDTH _______ HEIGHT _______

If a commercial or recreational capture, please provide contact information.

Environmental Data

	Water temp °C	**Salinity** ppt	**Depth** m	**DO** mg/L	**Refract**	**Conduct** mS	**Flow** m/s	**pH**
Surface			-					
Bottom								

Notes____

ID (database assignment) ____________