U.S. Army Corps of Engineers
Charleston District

APPENDIX F2

CHARLESTON HARBOR POST 45
CHARLESTON, SOUTH CAROLINA

National Marine Fisheries Service: Biological Opinion

May 2015

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

F/SER31:KMR
SER-2014-15433

MAY 11 2015

Lieutenant Colonel John Litz
District Engineer and Commander
Charleston District
United States Army Corps of Engineers
69A Hagood Avenue
Charleston, South Carolina 29403

Ref.: Charleston Harbor Post 45 Project: Amendment to the Biological Opinion

Dear Lieutenant Colonel Litz:

This letter constitutes an amendment to the April 22, 2015, Biological Opinion (Opinion) on the Charleston Harbor Post 45 Project. We received an email from Mr. Mark Messersmith requesting clarification of 4 items in the Opinion. The following constitutes the list of amendments for the Charleston Harbor Post 45 Project Opinion.

1. USACE question: Please see Section 2.1.3.2, Right Whale Avoidance Measures, page 19, item (5), beginning with "Operation AIS transmitters powered on and transmitting." This item states that USACE shall provide an end-of-project report including all AIS data "with any deviances from "(a)." Section 2.1.3.2 does not contain any subsections labeled as "(a)." Assume this sentence intended to refer to item (3) on page 19 discussing vessel speed restrictions. Please clarify.

   Amended language: This sentence should have referred to Section 2.1.3.2, item 3 on page 19 discussing vessel speed restrictions. Therefore, the language is amended to read, "with any deviances from (3) above[.]"

2. USACE question: Please see Section 9.1, Anticipated Amount or Extent of Incidental Take on page 103. The last sentence in the paragraph states: "NMFS also anticipates that capture trawling may result in up to 235 non-injurious captures and relocations of an estimated (up to) 719 loggerheads, 3 greens, 18 Kemp's ridley sea turtles, and 23 Atlantic sturgeon." The total number of non-injurious captures (235) is inconsistent with the non-lethal capture trawling limits for loggerheads (719) and the other species. From Table 10, it appears like the total should say "763". Please clarify the total number of non-injurious take.

   Amended language: The 235 number should not appear in the text. Therefore, the sentence is amended to read: "NMFS also anticipates that capture trawling may result in non-injurious captures and relocations of an estimated (up to) 719 loggerheads, 3 greens, 18 Kemp's ridley sea turtles, and 23 Atlantic sturgeon as calculated in Table 10."

3. USACE question: Please see Section 9.3, Reasonable and Prudent Measures, Reasonable and Prudent Measure (1) on page 104. The first sentence in the "Rationale" paragraph states: "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 make them less susceptible to entrainment." Believe this sentence should read "more" susceptible to entrainment instead of "less" susceptible. Please clarify.

   Amended language: The "less" language is in error. The sentence is amended to read, "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 make them more susceptible to entrainment."

4. USACE question: Please see Section 9.3.1, Terms and Conditions, Term and Condition (4), Operational Procedures, on page 105. The first sentence states "During periods in which hopper dredges are operating and NMFS-approved protected species observers are not required (December 1 through March 31), the USACE must:" This Term and Condition seems to conflict with Term and Condition (3) stating 2 observers are required during all hopper dredging, i.e. at all times. Please clarify.

   Amended language: Term and Condition 4, which is a provision of the Gulf of Mexico regional biological opinion for hopper dredging, was mistakenly included in this opinion. Therefore, Term and Condition 4 is removed from the opinion.

If you have any questions please contact Ms. Karla Reece, our consulting biologist for this project, at (727) 824-5348, or by email at karla.reece@noaa.gov.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

File: 1514-22.F.2

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
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F/SER31:KR
SER-2014-15433

APR 22 2015

Lieutenant Colonel John Litz
85th District Engineer and Commander
Charleston District
United States Army Corps of Engineers
69A Hagood Avenue
Charleston, South Carolina 29403

Ref.: Endangered Species Act Biological Opinion for Charleston Harbor Post 45 Project

Dear Lieutenant Colonel Litz,

The enclosed Biological Opinion ("Opinion") was prepared by the National Marine Fisheries Service (NMFS) pursuant to Section 7(a)(2) of the Endangered Species Act (ESA). The Opinion considers the effects of the proposed action on the following listed species: sea turtles (loggerhead, green, leatherback, hawksbill, and Kemp's ridley sea turtles), whales (North Atlantic right and humpback), sturgeon (Atlantic and shortnose), and the recently proposed critical habitat for the North Atlantic right whale. NMFS also concludes that the proposed action is not likely to jeopardize the continued existence of sea turtles (loggerhead, green, and Kemp's ridley sea turtles), and sturgeon (Atlantic and shortnose) and is not likely to adversely affect proposed North Atlantic right whale critical habitat, North Atlantic right and Humpback whales, and leatherback and hawksbill sea turtles.

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 U.S. Army Corps of Engineers (USACE) must comply to carry out the reasonable and prudent measures. Incidental take from actions described or evaluated in this Opinion that complies with these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

Please direct questions regarding this Opinion to Karla Reece, Consultation Biologist, by phone at 727-824-5312, or by email at karla.reece@noaa.gov.

Sincerely,

FOR Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure

File: 1514-22.F.2

Endangered Species Act

Biological Opinion

for the

Charleston Harbor Post 45 Project

NMFS Consultation Number: SER-2014-15433

Federal Action Agency: U.S. Army Corps of Engineers

Affected Species and Critical Habitat Determinations:

Common Name	Scientific Name	ESA Listing Status[1]	Action Agency Effect Determination[2]
Turtles			
Green	*Chelonia mydas*	E/T	LAA
Kemp's ridley	*Lepidochelys kempii*	E	LAA
Loggerhead	*Caretta caretta*	T	LAA
Hawksbill	*Eretmochelys imbricata*	E	NLAA
Leatherback	*Dermochelys coriacea*	E	NLAA
Fish			
Shortnose sturgeon	*Acipenser brevirostrum*	E	NLAA
Atlantic sturgeon	*Acipenser oxyrinchus*	E	LAA
Marine Mammals			
North Atlantic right whale	*Eubalaena glacialis*	E	NLAA
Humpback whale	*Megaptera novaeangliae*	E	NLAA
Critical Habitat			
North Atlantic right whale, Unit 2	Proposed for Designation February 20, 2015	Proposed	NLAA

Consultation Conducted By: National Marine Fisheries Service Southeast Region

Issued By: FOR Roy E. Crabtree, Ph.D. Regional Administrator

Date: April 22, 2015

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[1] E = Endangered, T = Threatened

[2] NLAA = may affect, not likely to adversely affect; LAA = may affect, likely to adversely affect

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

ASM	At Sea Monitoring
BA	Biological Assessment
CAFO	Concentrated Animal Feeding Operations
CCL	curved carapace length
CHP45	Charleston Harbor Post 45 Project
cm	centimeter(s)
CMP	Coastal Migratory Pelagics
CPA	Central Planning Area
CPUE	Catch Per Unit Effort
yd^3	cubic yard(s)
DNA	Deoxyribonucleic Acid
DO	Dissolved Oxygen
DPS	Distinct Population Segment
DQM	Dredging Quality Management
DTRU	Dry Tortugas Recovery Unit
EA	Environmental Assessment
EFDC	Environmental Fluid Dynamics Code
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
EWS	Early Warning System
F/SER3	NMFS Southeast Regional Office, Protected Resources Division
FMP	Fishery Management Plan
FP	Fibropapillomatosis
ft	feet/foot
FWOP	future without project
FWRI	Fish and Wildlife Research Institute
GADNR	Georgia Department of Natural Resources
GCRU	Greater Caribbean Recovery Unit
GOM	Gulf of Mexico
HSI	Habitat Suitability Index
IPCC	Intergovernmental Panel on Climate Change
ITS	Incidental Take Statement
LAA	may affect, likely to adversely affect

lb	pound(s)
MCY	million cubic yard(s)
MLLW	mean lower low water
MSA	Mixed Stock Analysis
NGMRU	Northern Gulf of Mexico Recovery Unit
NLAA	may affect, not likely to adversely affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRU	Northern Recovery Unit
NWA	Northwest Atlantic
ODMDS	Ocean Dredged Material Disposal Site
Opinion	Biological Opinion
PCB	polychlorinated biphenyls
PED	pre-construction engineering and design
PFRU	Peninsular Florida Recovery Unit
RM	River Mile
RPAs	Reasonable and Prudent Alternatives
RPMs	Reasonable and Prudent Measures
SAB	South Atlantic Bight
SARBO	South Atlantic Regional Biological Opinion
SCDNR	South Carolina Department of Natural Resources
SCL	straight carapace length
SEFSC	Southeast Fisheries Science Center
SERO	Southeast Regional Office
STDW	Sea Turtle Data Warehouse
STSSN	Sea Turtle Stranding and Salvage Network
T&Cs	terms and conditions
TED	turtle excluder devices
TEWG	Turtle Expert Working Group
TSP	Tentatively Selected Plan
UMAM	Uniform Mitigation Assessment Method
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
YOY	young-of-the-year

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 (of the Department of Commerce if NMFS, or the Department of the Interior if 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 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, monitors 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 Charleston Harbor Post 45 Project (CHP45). The U.S. Army Corps of Engineers (USACE) Charleston District is the permitting authority and will be carrying out the project. This Opinion analyzes project effects on ESA-listed species and proposed critical habitat in accordance with Section 7 of the ESA. This Opinion is based on project information provided by the USACE. Additional information for this Opinion was provided by the USACE, or was obtained from a variety of sources including published and unpublished literature cited herein and other sources of information including the USACE Sea Turtle Data Warehouse (STDW) (http://el.erdc.usace.army.mil/seaturtles/index.cfm).

1 CONSULTATION HISTORY

February 6, 2012 through October, 2014	Pre-consultation discussions: The scope of the project, data collection plans, sediment testing, and other project aspects were discussed in various meetings, conference calls, and emails between the USACE, NMFS, and other interested parties.
June 13, 2014	USACE sent NMFS the draft Biological Assessment (BA) for comment.
July 8, 2014	NMFS sent USACE comments, questions, and requests regarding information in the BA.
October 10, 2014	USACE formally requested Section 7 Consultation for the CHP45 and provided NMFS a copy of the Draft Integrated Feasibility Report and Environmental Impact Statement (DEIS). NMFS initiated consultation.
January 6, through February 23, 2015	NMFS requested additional information clarifying information in the DEIS and BA.
January 22, 2015	NMFS sent the project description for the Opinion to the USACE to review for accuracy.
January 23, 2015	USACE requested by email a copy of the Draft Opinion for review prior to the issuance of the Opinion.
January 30, 2015	USACE provided NMFS with a revised project description.
February 20, 2015	USACE requested conference on North Atlantic right whale proposed critical habitat.
March 16, 2015	USACE requested NMFS provide a copy of the draft Terms and Conditions and Reasonable and Prudent Measures (RPMs) from this Opinion.
March 20, 2015	NMFS provided USACE with the draft RPMS and Terms and Conditions (T&Cs).
March 25, 2015	USACE provided comments to NMFS regarding the draft RPMs and T&Cs.
March 26, 2015	NMFS and USACE held a conference call to discuss USACE concerns with the RPMS and T&Cs.
March 27, 2015	NMFS and USACE held a conference call to discuss the draft RPMs and T&Cs.
March 30, 2015	USACE notified NMFS they will propose North Atlantic right whale conservations measures (now included in Section 2.1.3.2 of this Opinion). As well, the USACE cancelled their request for a copy of the Draft Opinion.
April 3, 2015	The USACE revised the project description to include a conservation measure related to the North Atlantic right whale (Section 2.1.3.2 of this Opinion)

2 DESCRIPTION OF THE PROPOSED ACTION AND THE ACTION AREA

2.1 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies. NMFS's determination regarding the effects of the proposed action is based on the description of the action in this section of the Opinion. Any changes to the proposed action may negate the findings of the present consultation and may require reinitiation of consultation with NMFS.

The Tentatively Selected Plan (TSP) as described in the DEIS proposes to extend and deepen the entrance channel in combination with deepening and widening the inner harbor channels that primarily serve containerships (Figure 1). The proposed navigation improvements include:

- Deepen the existing entrance channel from a project depth of -47 feet (ft) to -54 ft mean lower low water (MLLW) over the existing 800-ft bottom width, while reducing the existing stepped 1,000-ft width to 944 ft from an existing depth of -42 ft to a depth of -49 ft MLLW (fully described in section 2.1.3.1 of this Opinion and depicted in Figure 6 of that section). The proposed deepening of the entrance channel also includes 1-2 ft of required overdepth dredging and up to an additional 2 ft of allowable overdepth dredging.
- Extend the entrance channel approximately 3 miles seaward to about the -57 ft MLLW contour.
- Deepen the inner harbor from an existing project depth of -45 ft to -52 ft MLLW to the Wando Welch Terminal on the Wando River and the new SCSPA Navy Base Terminal on the Cooper River, and from -45 ft to -48 ft MLLW for the reaches above that facility to the Northern Charleston Terminal (over varying expanded bottom widths ranging from 400-1,800 ft). The proposed deepening of the inner harbor also includes overdepth dredging and advance maintenance dredging as outlined in Appendix A of the DEIS (USACE 2014).
- Enlarge the existing turning basins to a 1,800-ft diameter at the Wando Welch and new Navy base terminals to accommodate Post Panamax Generation II and Generation III container ships.
- Enlarge the North Charleston Terminal turning basin to a 1,650-ft-diameter to accommodate Post Panamax Generation II and Generation III container ships.
- Raise dikes and place dredged material from the upper harbor at the existing upland confined disposal facilities at Clouter Creek, Yellow House Creek, and Daniel Island; place material dredged from the lower harbor and sediment from the entrance channel at the expanded Ocean Dredged Material Disposal Site (ODMDS). Place some of the rock dredged from the entrance channel along the outside of the entrance channel and along the edges of the ODMDS to create hard bottom habitat.

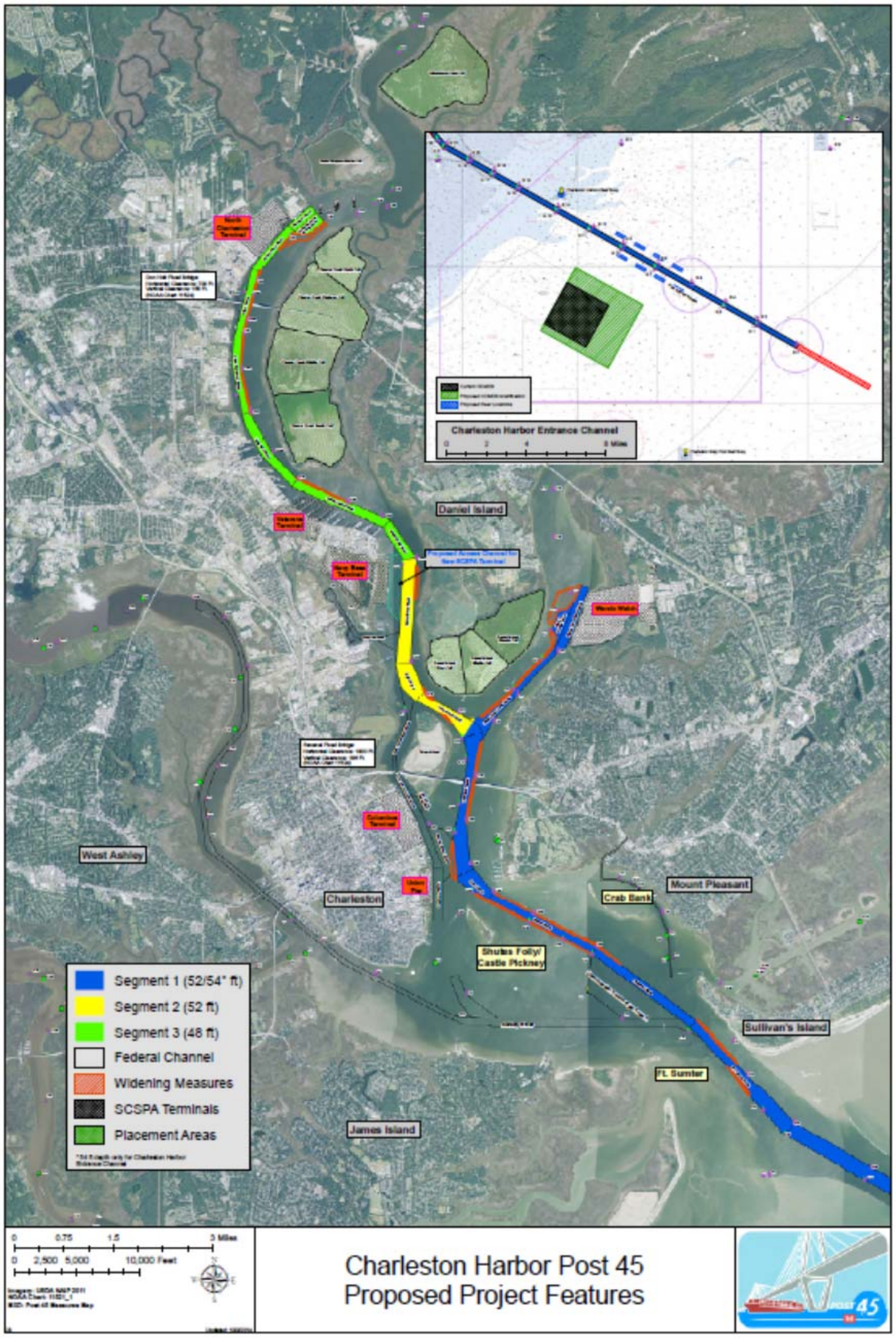


Figure 1. CHP45 Project (USACE 2014)

The TSP will indirectly impact about 281 acres of freshwater wetlands (emergent and forested) through changes in salinity, which could require compensatory mitigation in the form of preservation and conveyance of an estimated 831 acres to the U.S. Forest Service (USACE 2014). Additionally, direct impacts to about 29 acres of hard bottom habitat within the footprint of the entrance channel extension footprint require mitigation. To compensate for impacts to hard bottom habitat, rock dredged from the entrance channel will be used to construct artificial reefs. Two reefs will be constructed specifically to compensate for lost habitat in the channel and 6 reefs will be constructed as a beneficial use of dredged material. In total, 8 new 33-acre artificial reefs will be created along the margins of the entrance channel. Additionally, at the request of the South Carolina Department of Natural Resources (SCDNR), approximately 240,000 cubic yards (yd^3) of rock material will also be placed at SCDNR's existing 25-acre Charleston Nearshore Reef. The total quantity of reef habitat created far exceeds the required mitigation. However, construction of the reefs near the entrance channel is less expensive than transporting the material to the ODMDS. The total amount of reef habitat created was limited based on conversations with SCDNR biologists in order to maintain an appropriate and productive balance of habitat types in the area.

2.1.1 Dredging

Construction of the TSP will generate about 40 million cubic yards (MCY) of dredged material. Of that, about 29 MCY will be placed in the offshore ODMDS; 2.9 MCY will be placed in Daniel Island Disposal Area; 900,000 yd^3 will be placed in Clouter Creek Disposal Area; 2.3 MCY will be placed in Yellow House Creek Disposal Area; 360,000 yd^3 will be used for artificial reef mitigation; approximately 6.3 MCY for ODMDS berm construction; 1.9 MCY for reef construction along either side of the Entrance Channel; and 240,000 yd^3 will be placed at an existing DNR artificial reef site. The proposed action would increase the area dredged from about 3,619 acres (for the current Charleston Ship Channel) to about 4,152 acres. Of the additional 533 acres that would be affected by proposed dredging, about 349 acres of the additional dredging area would result from the extension of the Entrance Channel and the remaining 184 acres of additional area to be dredged would result from channel widening. All areas to be dredged are shown in Figure 1.

The exact construction methodology will be determined by the contractor selected through contracting process. However, assumptions regarding various construction techniques that could be used were made for planning and estimating purposes as detailed in Table 1. Dredged material from widening and deepening efforts will be excavated using a hydraulic cutterhead dredge, hopper dredge, or mechanical excavator. Based on testing results (found in Appendix B of the DEIS;(USACE 2014), the rock material will not require blasting).

Table 1. Dredging areas, dredging methods, quantity, and duration (USACE 2014)

Channel Reach	Dredge Type	Number of Dredges	Estimated Number of Vessel transits	Placement Area	Dredge Quantity in Cubic Yards (yd^3)	Duration (Months)
Fort Sumter Reach, EC1	Large Hopper	1	524	ODMDS	2,357,022	4.06
Fort Sumter Reach, EC1	Medium Hopper	3	1,571	ODMDS	3,928,371	4.24
Fort Sumter Reach, EC1	Rock cutter	1	378	ODMDS Berm	2,266,766	8.72
Fort Sumter Reach, EC1	Rock cutter	1	10	DNR Site	60,000	0.34
Fort Sumter Reach, EC1	Rock cutter	1	70	Reef Placement	420,000	1.77
Fort Sumter Reach, EC1	Clamshell with bucket	1	110	ODMDS Berm	660,000	6.51
Fort Sumter Reach, EC1	Clamshell w/rock bucket	1	60	Mitigation Site	360,000	3.98

Channel Reach	Dredge Type	Number of Dredges	Estimated Number of Vessel transits	Placement Area	Dredge Quantity in Cubic Yards (yd^3)	Duration (Months)
Fort Sumter Reach, EC1	Clamshell w/rock bucket	1	30	DNR Site	180,000	1.99
Fort Sumter Reach, EC2	Large Hopper	1	432	ODMDS	1,943,512	3.54
Fort Sumter Reach, EC2	Medium Hopper	3	1,166	ODMDS	2,915,267	3.70
Fort Sumter Reach, EC2	Rock cutter	1	557	ODMDS Berm	3,346,872	12.77
Fort Sumter Reach, EC2	Rock cutter	1	70	Reef Placement	420,000	1.91
Fort Sumter Reach, EC2	Clamshell w/rock bucket	1	180	Reef Placement	1,080,000	10.97
Mount Pleasant Reach	Clamshell	1	140	ODMDS	840,083	1.52
Rebellion Reach	Clamshell	1	180	ODMDS	1,081,341	1.96
Bennis Reach	Clamshell	2	324	ODMDS	1,942,858	2.80
Horse Reach	Clamshell	2	59	ODMDS	350,996	0.53
Hog Island Reach	Clamshell	2	352	ODMDS	2,109,994	3.15
Wando River Lower Reach	Clamshell	2	295	ODMDS	1,769,070	2.55
Wando River Upper Reach	Clamshell	2	106	ODMDS	636,251	1.05
Wando River Turning Basin	Clamshell	2	547	ODMDS	3,284,633	4.52
Segment 1 Total					**31,953,036**	**82.58**
Drum Island Reach	Clamshell	2	153	ODMDS	917,473	1.45
Myers Bend	Clamshell	2	142	ODMDS	853,689	1.28
Daniel Island Reach	Pipeline	2	N/A	Daniel Island	2,211,957	2.17
Segment 2 Total					**3,983,119**	**4.9**
Daniel Island Bend	Pipeline	2	N/A	Daniel Island	74,551	0.28
Clouter Creek Reach	Pipeline	2	N/A	Daniel Island	583,150	1.23
Navy Yard Reach	Pipeline	2	N/A	Clouter Creek	358,816	0.74
North Charleston Reach	Pipeline	2	N/A	Clouter Creek	532,693	0.61
Filbin Creek Reach	Pipeline	2	N/A	Yellow House Creek	405,420	0.75
Filbin/Port Terminal Intersect	Pipeline	2	N/A	Yellow House Creek	31,692	0.08
Port Terminal Reach	Pipeline	2	N/A	Yellow House Creek	160,376	0.3
Ordnance Reach	Pipeline	2	N/A	Yellow House Creek	118,091	0.33
Ordnance Reach Turning Basin	Pipeline	2	N/A	Yellow House Creek	1,549,313	1.7
Segment 3 Total					**3,814,102**	**6.02**
North Charleston Terminal Berthing Area	Pipeline	1	N/A	Yellow House Creek	41,001	0.21

Channel Reach	Dredge Type	Number of Dredges	Estimated Number of Vessel transits	Placement Area	Dredge Quantity in Cubic Yards (yd^3)	Duration (Months)
Navy Base Terminal Berthing Area	Pipeline	1	N/A	Daniel Island	474,551	1.03
Wando Terminal Berthing Area	Pipeline	1	N/A	Daniel Island	157,633	0.32
Berthing Areas Total					**673,185**	**1.56**
Total Construction					**40,423,442**	**95**

2.1.1.1 Dredged Material Placement

Material dredged from channel deepening and widening will be distributed among the ODMDS, 2 mitigation-required reef construction sites, 6 beneficial use reef construction sites, a DNR reef construction site, and upland confined disposal areas as summarized in Table 1 and shown in Figures 2 and 3. The improvements that will be required include the raising of dikes within the footprint of the existing upland confined disposal facilities at Clouter Creek, Yellow House Creek, and/or Daniel Island and the expansion of the existing ODMDS to provide increased capacity for new work and maintenance material (Action being addressed jointly by the U.S. Environmental Protection Agency [EPA] and USACE in a Section 102 site modification Environmental Assessment [EA]). The ODMDS is in the process of being expanded by the EPA and should be available prior to project construction. Section 7 consultation for the ODMDS expansion will be carried out separate from this Opinion.

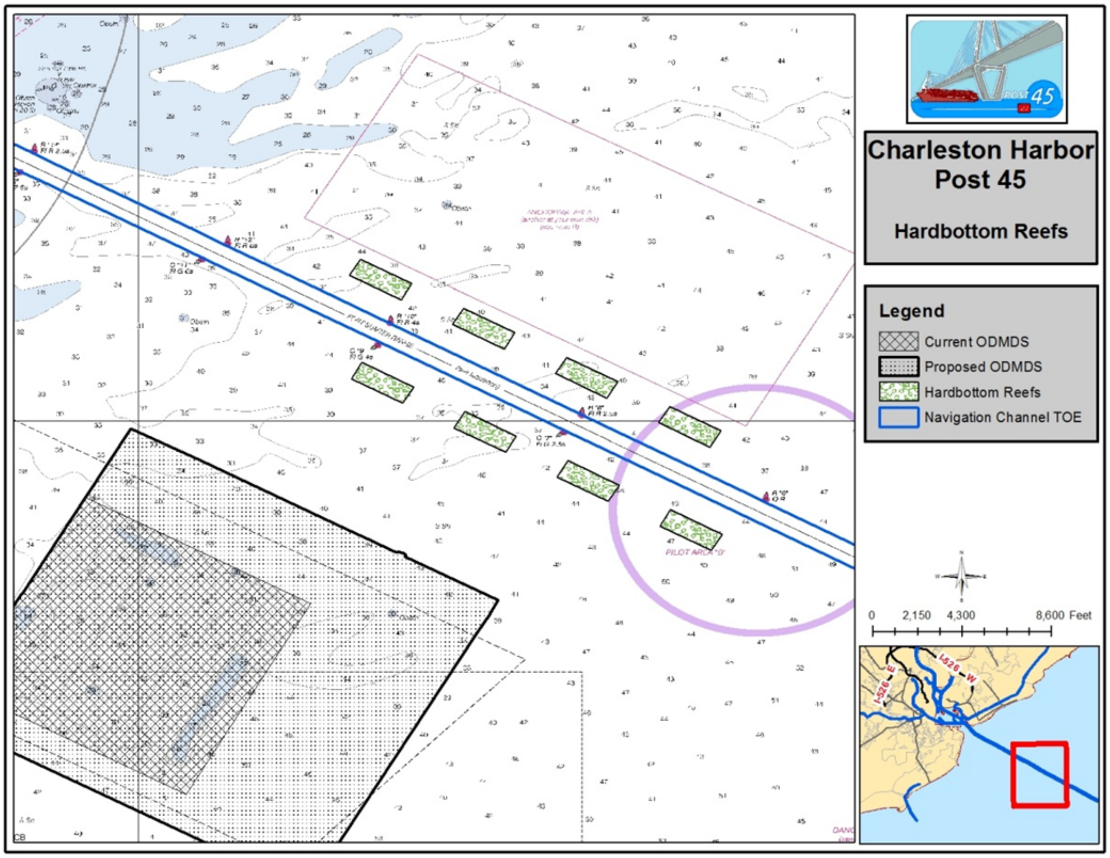


Figure 2. Location of the ODMDS (current and proposed expanded) and approximate locations for hard bottom reefs. Image from the DEIS (USACE 2014)

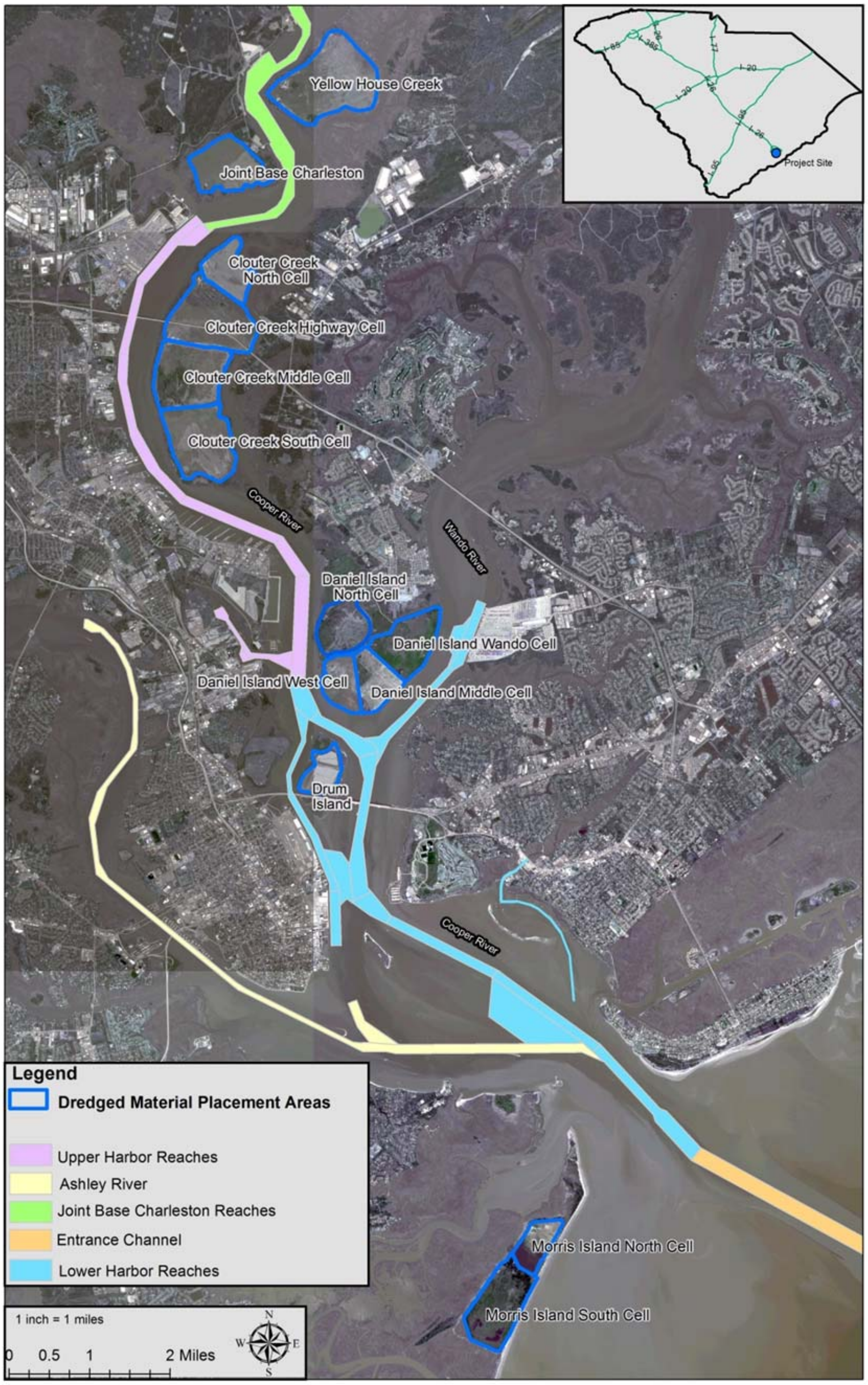


Figure 3. The locations of dredged material disposal sites in Charleston Harbor.
The Morris Island North and South cells may receive material beneficially as described in Section 2.1.1.4.3 (USACE 2014)[3].

[3] Drum Island and Morris island are depicted on Figure 3 as being a disposal area, but no dredged material will be placed in those areas, according to the DEIS (USACE 2014).

2.1.1.2 Dredge Material Transport Vessels

Three types of barges are generally used to transport dredged material to disposal sites, which include a split hull barge/scow, bottom dump barge/scow, or a flat-top barge/scow. All 3 barge types are typically pushed or pulled to the disposal site by a tug and travel at slow speeds. Medium sized hopper dredges will operate below 10 knots at all times, both fully loaded and unloaded. While large hoppers can travel at speeds of 11.1 knots while loaded and 12.8 knots while unloaded, the USACE has committed to voluntary speed reductions as described in Section 2.1.3.2, with all dredge related vessels operating in the Atlantic Ocean to travel at speeds under 10 knots from November 1 through April 30 as a conservation measure to protect right whales. Approximately 7,456 vessel transits will carry dredged material to the ODMDS site or other beneficial use sites in the ocean (Table 2).

Table 2. Number of Vessel Transits to Dispose Dredged Material

Channel Reach	Dredge Type	Placement Area	Estimated Number of Transits
Fort Sumter Reach, EC1	Large Hopper	ODMDS	524
Fort Sumter Reach, EC1	Medium Hopper	ODMDS	1,571
Fort Sumter Reach, EC1	Rock cutter	ODMDS Berm	378
Fort Sumter Reach, EC1	Rock cutter	DNR Site	10
Fort Sumter Reach, EC1	Rock cutter	Reef Placement	70
Fort Sumter Reach, EC1	Clamshell with bucket	ODMDS Berm	110
Fort Sumter Reach, EC1	Clamshell w/rock bucket	Mitigation Site	60
Fort Sumter Reach, EC1	Clamshell w/rock bucket	DNR Site	30
Fort Sumter Reach, EC2	Large Hopper	ODMDS	432
Fort Sumter Reach, EC2	Medium Hopper	ODMDS	1,166
Fort Sumter Reach, EC2	Rock cutter	ODMDS Berm	557
Fort Sumter Reach, EC2	Rock cutter	Reef Placement	70
Fort Sumter Reach, EC2	Clamshell w/rock bucket	Reef Placement	180
Mount Pleasant Reach	Clamshell	ODMDS	140
Rebellion Reach	Clamshell	ODMDS	180
Bennis Reach	Clamshell	ODMDS	324
Horse Reach	Clamshell	ODMDS	59
Hog Island Reach	Clamshell	ODMDS	352
Wando River Lower Reach	Clamshell	ODMDS	295
Wando River Upper Reach	Clamshell	ODMDS	106
Wando River Turning Basin	Clamshell	ODMDS	547
Drum Island Reach	Clamshell	ODMDS	153
Myers Bend	Clamshell	ODMDS	142
Approximate number of vessel transits:			**7,456**

2.1.1.3 Disposal Area Modifications

Disposal area modifications will occur in the uplands at Yellow House Creek Disposal Area, Daniel Island Disposal Area, and Clouter Creek Disposal Area and will increase the capacity for these disposal areas.

2.1.1.4 Beneficial Use of Dredged Material

The CHP45 will use dredged material beneficially for ODMDS berm creation, hard bottom habitat creation (reef locations), and possibly for other beneficial uses not yet determined.

2.1.1.4.1 ODMDS Berm Creation

To protect hard bottom habitat, from being buried by sediment migrating from the ODMDS, limestone rock from the entrance channel will also be used to construct an “L” shaped berm along the south and west perimeters of the ODMDS (Figure 4). This area represents approximately 427 acres of the ODMDS. The dimensions will be roughly 15,000 ft by 16,000 ft by 600 ft. The berm will be built on roughly a 3:1 slope, and will rise to about 10 ft above the natural bottom elevation but no higher than -25 ft MLLW. The reef will serve multiple purposes, including hard bottom habitat, fish habitat, and sediment containment. This beneficial use project will use smaller material to create the base of the berm and the outer portion of the berm will be created with larger rock dredged with a clamshell dredge. This will serve to increase the surface area of the reef, thereby enhancing habitat value.

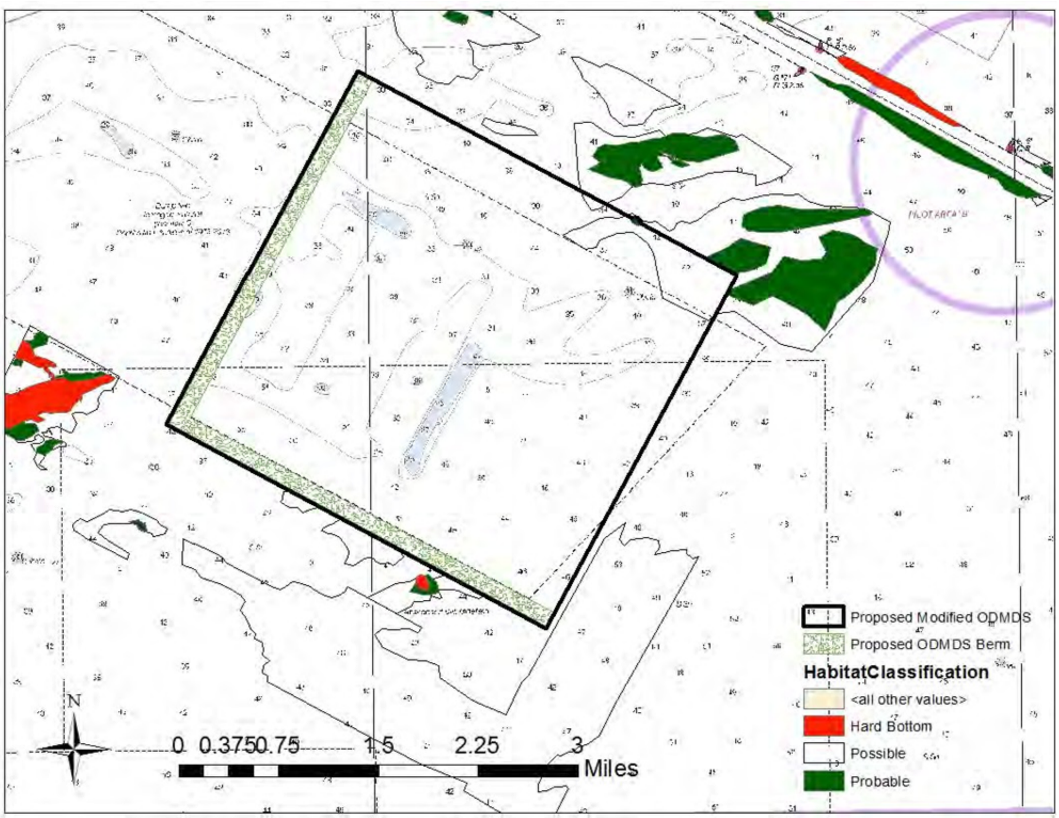


Figure 4. Proposed ODMDS and location of hard bottom habitat and the sediment containment/habitat berm (USACE 2014)

2.1.1.4.2 Hard Bottom Habitat Creation

Limestone rock will be dredged from within the entrance channel and used to create as substrate for sessile invertebrates, and structure for fish species after being placed within strategic locations nearby the channel. The USACE will construct 8 new 33-acre reef sites: 4 located along the north side of the channel and 4 located along the south side of the channel (Figure 2). Prior to construction, the locations of these reefs will be refined and coordinated with the resource agencies. These reefs will provide extensive bathymetric features located between approximately 6 nautical miles (nmi) offshore of Charleston Harbor out to approximately 10 nmi. Two of the reefs will be constructed to optimize hard bottom habitat for use as mitigation sites, and the other 6 sites will be specifically for beneficial use of dredged material. More detail on the hard bottom reef sites can be found in Appendix H (Hard Bottom Resources) and Appendix P (Mitigation) of the DEIS (USACE 2014). Additionally, at the request of the SCDNR Artificial Reef Program, approximately 240,000 yd^3 of rock material will also be deposited at the 25-acre Charleston Nearshore Reef site. The SCDNR Charleston Nearshore Reef site is discussed in Appendix M2 (404(b)(1) evaluation) (USACE 2014)(Figure 5), because it is within state waters inside of the 3-nmi limit.

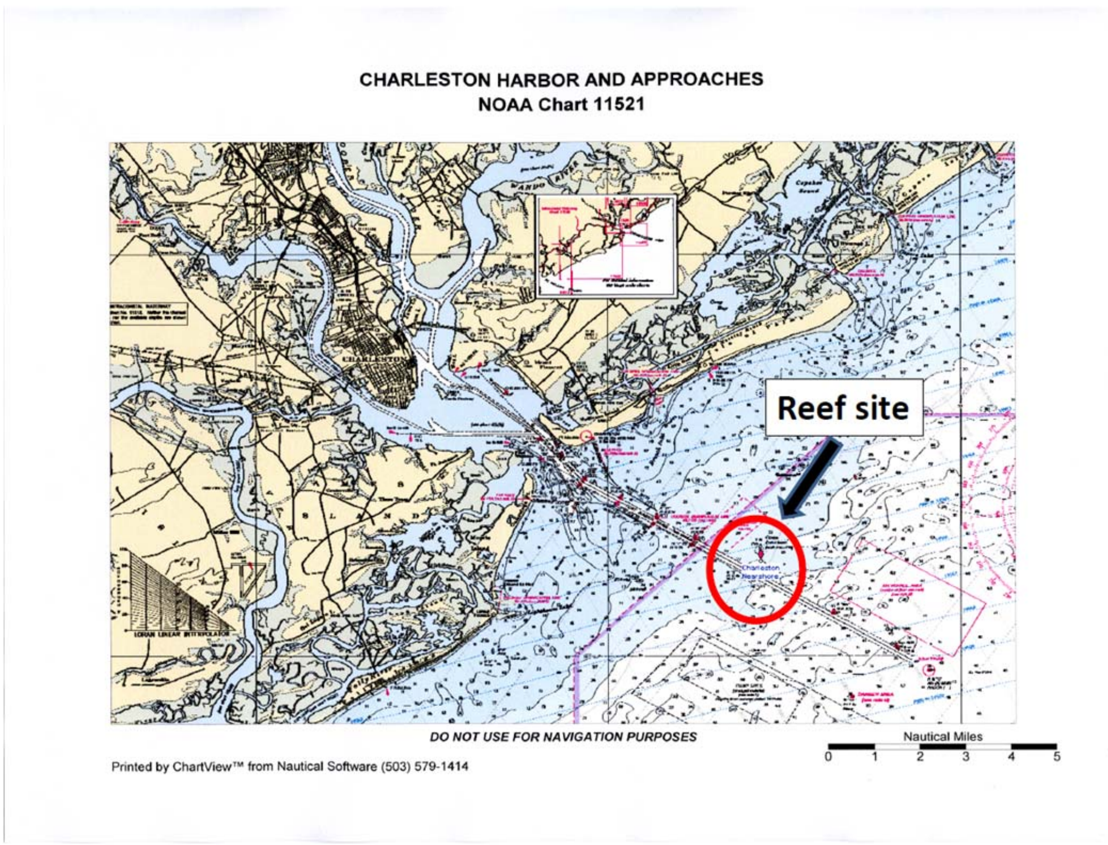


Figure 5. SCDNR Nearshore Reef Site Location (USACE 2014)

Two Mitigation Sites: A grid-based approach will be used to construct the reef structures at the mitigation sites. Each site will consist of sixteen (16) 300-ft by 300-ft cells that combine to create a 33-acre patch reef area about 600 ft wide and 2,400 ft long. The cell arrangement will be 2 across by 8 long. The 16 cells will each require 8,000-12,000 yd^3, or approximately 128,000-192,000 yd^3 total of fill material to create the desired peak vertical relief of 3.5-4.5 ft (after settling) and the desired aerial coverage within each cell of 75%. All of the material used to construct the mitigation sites will be excavated using a clamshell dredge to maximize the size of the material used to construct the reef and minimize dispersal of the material.

6 Placement Sites: The 6 new 33-acre placement sites will each have the same dimensions as the mitigation sites (600 ft wide by 2,400 ft long). Dredged material will be placed to cover the entire area to a peak relief height of about 10 ft (after settlement) and tapering to natural contours/conditions at the site margins. Each site will utilize about 320,000 yd^3 of material. Smaller material generated by the hopper dredges will be used to create a base that will be covered with larger material dredged using clamshell dredges to create the desired habitat. To estimate volumes, it was assumed that the average height of material will be about 6 ft based on a peak relief height of about 10 ft and tapering to 0 ft at the margins of the sites.

2.1.1.4.3 Other Potential Beneficial Use Sites

Other locations identified as possible beneficial use sites are: Crab Bank enhancement, Shutes Folly Enhancement, bird nesting island creation, and nearshore placement off Morris Island. In all cases, the precise size and scope of the projects will be determined during the pre-construction, engineering, and design (PED) phase, and will be dependent on a source of suitable material. Because detailed information about the size, scope, and construction methodology is not available for these beneficial use sites, they cannot be analyzed in a meaningful way in this Opinion and therefore are not analyzed as part of the action. The USACE may need to reinitiate this consultation should they opt to move forward with these beneficial use sites.

Post-Dredging Operations

Since dredging equipment does not typically result in a perfectly smooth and even channel bottom (see discussion above), a drag bar, chain, or other item may be pulled along the channel bottom to smooth down high spots and fill in low spots. This finishing technique also reduces the need for additional dredging to remove any high spots that may have been missed by the dredging equipment. Historically, these types of activities have not been required in the project area; however they may occur from Myers Bend and the Wando River downstream to Segment 1 in the entrance channel. The USACE has not yet determined the extent of post-dredging operations that will be required.

Operations and Maintenance Considerations

Maintenance dredging will generally be conducted by hopper, clamshell, and cutterhead dredges and will operate essentially the same as current practices documented in the Charleston Harbor Dredged Material Management Program Preliminary Assessment. Maintenance dredging will use the same placement areas as those used for existing conditions, and the duration and frequency of dredging events will not change due to the proposed project. All future maintenance dredging in Charleston Harbor and the entrance channel will be carried out under the NMFS South Atlantic Regional Biological Opinion (SARBO)(NMFS 1997b) and will not be discussed further in this Opinion[4].

[4] SARBO is currently being revised and updated and will address the impacts of dredging a bigger and deeper channel.

2.1.2 Freshwater Wetlands Mitigation

Indirect wetland impacts are predicted to occur through a shift from fresh/brackish wetland vegetation to brackish/salt wetland vegetation. The impacts result from converting one dominant type of wetland vegetation to another (freshwater to salt tolerant species). The USACE has used the Uniform Mitigation Assessment Method (UMAM), as defined in Florida Administrative Code (FAC) 62-345, to determine the necessary amount of compensatory mitigation. Using the UMAM tool, the proposed project will require approximately 831 acres of freshwater forested and emergent wetlands throughout these parcels. The Charleston District has determined that preservation of land within the proclamation boundary of the Francis Marion National Forest best meets of the compensatory mitigation requirements. The preserved lands will provide important physical, chemical, and biological functions for the Cooper River Basin and will contribute to the sustainability of the watershed by ensuring the functions of bottomland hardwood wetlands and emergent wetlands on these properties are sustained in perpetuity.

2.1.3 Conservation Measures

Below are the conservation measures the USACE will implement during the construction of the CHP45 to avoid impacts to ESA-listed species and associated habitats. All conservation measures are described fully in Appendix P of the DEIS (USACE 2014).

2.1.3.1 General Conservation Measures:

1. No Anchoring in Hard Bottom Habitat: As a means to avoid or minimize effects of anchorage during dredging on hard bottom habitat, the design specifications will be written to require the contractor to avoid anchoring of equipment within adjacent hard bottom habitat. The approximate locations of these resources will be shown in the contract drawings. If the contractor is required to anchor outside the channel to utilize a cutterhead dredge, the anchor(s) shall be placed to avoid affecting any of the identified hard bottom habitat or any of the created hard bottom habitat reefs.

2. Hard Bottom Habitat Impact Minimization: The existing channel side slopes will be maintained by extending them downward, rather than the more typical approach of maintaining the existing bottom width and extending the side slopes outward. The measure would avoid all direct impacts to hard bottom habitat along the margins of the entrance channel (Figure 6).

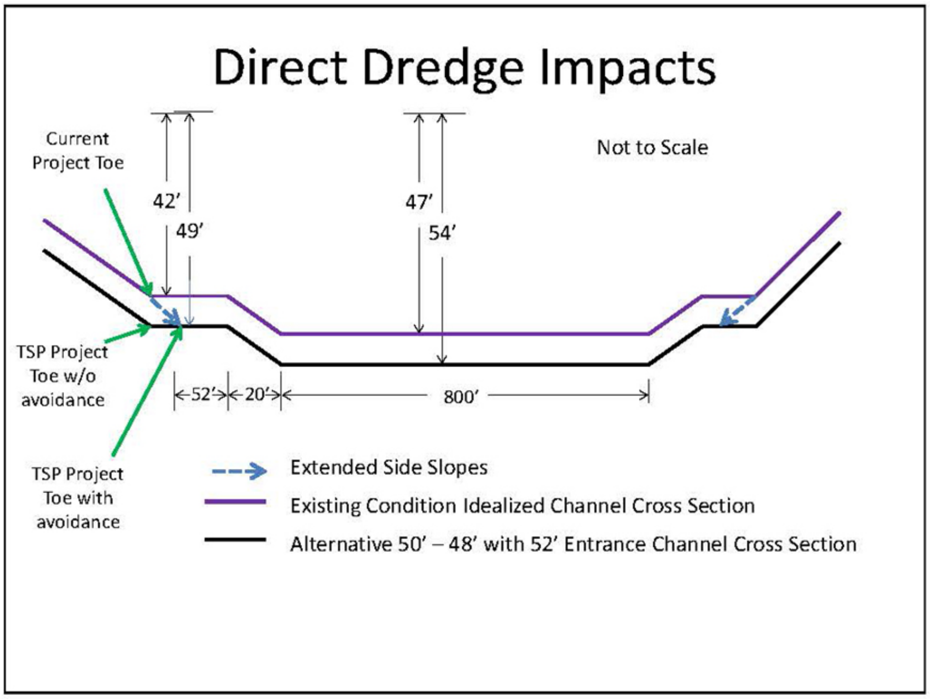


Figure 6. Proposed side slope extension to avoid hard bottom areas (USACE 2014)

3. No Blasting: Geotechnical investigations involving rock strength analysis indicates the rock that requires removal to obtain the project depth can be removed with either a cutterhead dredge or a rock bucket clamshell dredge and will not require blasting. As a result of their analysis, blasting will not be used, therefore eliminating any potential effects resulting from noise impacts to marine mammals and fish that blasting may cause.

4. Dredging Quality Management (DQM) will be used to monitor dredged material placement in the ODMDS and other nearshore disposal sites.

5. Observer Requirement: For the construction of the proposed project, during transit to and from offshore disposal areas, an observer will monitor from the bridge during daylight hours for the presence of endangered species.

2.1.3.2 Right Whale Avoidance Measures

The USACE has established precautionary collision avoidance measures to be implemented during dredging and disposal operations that take place during the time North Atlantic right whales are present in waters offshore of USACE projects (between November 1 and April 30). For the construction of the proposed project, these precautionary measures include[5]:

[5] The Corps of Engineers (Corps) has assessed these conditions specific to resource protection within the Charleston Harbor area and their effect on the ability of the Corps to execute this project considering the anticipated additional costs associated with these measures. The Corps has indicated that while these conditions are acceptable for this project at this time, every Corps project is evaluated independently and the Corps does not endorse a generic application of these conditions to other Corps projects. Further, the Corps' inclusion of these conditions is not an endorsement of the application of these conditions to any project of any other federal agency.

1. Before the initiation of each project, at the pre-construction/partnering meeting, the USACE will brief the contractor on the presence of the species, and review the requirements for right whale protection.

2. Each contractor will be required to instruct all personnel associated with the dredging/construction project about the possible presence of endangered North Atlantic right whales in the area and the need to avoid collisions. Each contractor will also be required to brief his or her personnel concerning the civil and criminal penalties for harming, harassing, or killing species that are protected under the ESA and the Marine Mammal Protection Act of 1972. Dredges and all other disposal and attendant vessels are required to stop, alter course, or otherwise maneuver to avoid approaching the known location of a North Atlantic right whale. The contractor will be required to submit an endangered species watch plan that is adequate to protect North Atlantic right whales from the impacts of the proposed work.

3. Dredge-related vessel speed reductions to protect whales: From November 1 through April 30, all project vessels operating in the Atlantic Ocean that are greater than or equal to 65 ft in overall length will maintain a speed of 10-knots or less during right whale migration/calving season while in specified areas designated as proposed right whale critical habitat and slow to 5 knots or the minimum safe navigable speed when visibility is reduced by night, fog, precipitation, or if sea state is greater than 3 ft. As set forth in this proposed action, the speed limits for project vessels shall only apply until a new SARBO is signed, at which time the project would abide by the conditions set forth in the new SARBO.

4. Whale observers: From November 1 through April 30, one observer with at-sea large whale identification experience will be on watch 100% during daylight hours (30 mins before sunrise to 30 mins after sunset).

5. Operational AIS transmitters powered on and transmitting: The USACE shall provide NMFS's Southeast Regional Office (takereport.nmfsser@noaa.gov with reference to this Opinion) with an end-of-project report including all AIS data with any deviances from (a) within 30 days of completion of the North Atlantic right whale migration and calving season (April 30). This report may be incorporated into the final report summarizing the results of the hopper dredging project.

2.1.3.3 Sea Turtles

1. Relocation Trawling: USACE will coordinate with NMFS staff to determine if relocation and abundance trawling during hopper dredging is necessary if and when an excessive level of take has occurred during project construction[6].

2. Environmental Windows: The environmental windows for turtle-safe hopper dredging have targeted the winter months since sea turtle abundance is dramatically reduced at

[6] Because the USACE does not specify a trigger for relocation trawling, NMFS must specify what the trigger is and how relocation trawling will be implemented in the T&Cs of this Opinion in order to authorize any relocation trawling incidental take.

water temperatures below 13°C and typically absent during temperatures below 11°C (Moon et al. 1997; STAC 2006). The typical environmental window for Charleston Harbor maintenance hopper dredging is December 1 through March 31[7]. During construction of the proposed project, the USACE will follow this window; however, if conditions are such that it's beneficial to continue dredging, the window may be expanded to April 30. No environmental windows are necessary for mechanical or hydraulic cutterhead dredging.

3. Hopper Dredging: The USACE will conduct all CHP45 hopper dredging consistent with Reasonable and Prudent Measures (RPMs) outlined in the current SARBO or any subsequent revisions of SARBO (NMFS 1997b). These measures include but are not limited to inflow/overflow screening, observers, etc.

2.1.4 Monitoring and Adaptive Management:

The Mitigation Monitoring and Adaptive Management Plan is detailed in Appendix P of the DEIS (USACE 2014). Listed below are the components specific to dredging, disposal, and ecosystem changes. These descriptions are found in the DEIS is full detail.

2.1.4.1 Monitoring during Construction

A real-time placement monitoring/verification system, or DQM, will be used to monitor placement within specific patterns and tolerances as well as to monitor how the placement actually occurred. The use of DQM is required for USACE federal navigation projects that use a scow or hopper dredge to dispose of material in an ODMDS. Information regarding vessel loads, vessel tracks, and discharge time and location records is recorded and maintained in the DQM system and will provide 24/7 coverage of operations. Bathymetric surveys will be completed twice during construction of the reef to ensure that each of the cells in the mitigation reef plan are obtaining a peak vertical relief of 4-5 ft. If the cells are not reaching the desired relief with 1 scow load, additional scows will be directed to those sites.

2.1.4.2 Post-Construction Monitoring

Approximately 20% (~ 6 cells) of the mitigation reef cells will be analyzed similar to the methods described in Appendix P of the DEIS, Section 5.1.1.1 "Pre-Construction Impact Refinement." The cells will be chosen either randomly or strategically based on input from SCDNR and NMFS. Monitoring will occur within 6 months of completion of the reef and will continue once a year for 4 years in order to fully account for the anticipated 3.5 years until recovery. If the ecological success criteria, based on the abundance and diversity of sessile invertebrates at the impact site, are met prior to the completion of 4 years of monitoring, a meeting will be held with the resource agencies and monitoring efforts will be ceased. If success criteria are not met at the end of 4 years, USACE will meet with SCDNR and NMFS to determine corrective actions.

2.1.4.3 Water Quality Monitoring

The objective of the water quality monitoring effort for this study will be to determine if there is a significant difference between pre- and post-construction water quality data (Appendix P, Section 5.3 of the DEIS). If there is a significant increase beyond the model-predicted changes,

[7] The SARBO dredging window for hopper dredging in the Charleston area is November 1 through May 31.

consultation with resource agencies will be used to develop adaptive management measures for dissolved oxygen (DO) and indirect wetland impacts from salinity changes. Continuous data collection of mid-depth and bottom salinity and DO at high and low tides will be collected for at least 1 year before construction, during construction, and after construction throughout the Charleston Harbor estuary, including the Ashley, Cooper, and Wando Rivers.

2.1.4.4 Monitoring for Beneficial Use of Dredged Material Projects

Beneficial uses have been proposed for this project including expanding Crab Bank, expanding/protecting Shutes Folly, nearshore placement off Morris Island, and/or a new bird nesting island off the south jetty. Since details related to beneficial use have been moved to the PED phase of the project, details have not yet been established for monitoring plans.. Monitoring for any of these projects will be coordinated with the resource agencies and will be consistent with the goals of the project and USACE's Engineering With Nature Program principles.[8]

2.2 Summary of the Proposed Action

Because some of the exact details for construction of the project are not yet determined, we plan to complete our analysis with the available information, resolving any remaining uncertainties in a precautionary manner to protect the species. Therefore, in the absence of finalized project plans, we will complete this Opinion based on the following assumptions that could be considered the worst case scenario of all options:

1. Approximately 40 MCY of material will be removed from the Port of Charleston and the Charleston entrance channel.

2. Hopper dredging (the most harmful means of dredging to the species affected by the action) will be carried out only in the Fort Sumter Reach (areas EC1 and EC2). Approximately 11.15 MCY of material will be dredged using a hopper dredge.

3. Dredging will be conducted year-round for a period of 6 years with hopper dredging carried out only during the appropriate environmental window spelled out in Section 2.1.3.3, item 2.

4. Approximately 7,456 loads (depending on the size of the transport barges or hopper dredges used) of dredged material will be transported to offshore ODMDS and beneficial use locations.

5. General plans for the beneficial use of dredged material have been spelled out in Section 2.1.1.4 of this Opinion. The USACE has committed to choosing beneficial use locations that will not interfere with existing hard bottom. Should beneficial use locations impact hard bottom, potentially affect ESA-listed species, or any designated critical habitat under the purview of NMFS, the USACE will need to reinitiate consultation.

[8] The Engineering With Nature Program enables more sustainable delivery of economic, social, and environmental benefits associated with water resources infrastructure. http://el.erdc.usace.army.mil/ewn/

6. The USACE has not yet determined the extent of post-dredging operations (bed-leveling or similar activities) that will be required, but it has stated that they may occur from Myers Bend and the Wando River downstream to Segment 1 in the entrance channel. In the absence of a description of the extent of effort expected, we must assume that they will occur in this entire area.

2.3 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). Charleston Harbor is located in a natural tidal estuary, formed by the confluence of the Cooper, Ashley, and Wando Rivers. The project area encompasses the offshore entrance channel, offshore and landside confined dredged material disposal sites, inner harbor channels, and any extension of the water bodies and shorelines that could be impacted by proposed improvements (Figure 1). For purposes of this consultation, NMFS will consider the action area to be all areas to be widened and/or dredged from the North Charleston Terminal down the Cooper River and from the Wando Welch Terminal down the Wando River to the confluence with the Cooper River, out the entrance channel to a point approximately 17.3 miles offshore to the sea buoy and from the entrance channel to the hard bottom habitat creation (reef) areas, the SCDNR reef, and the ODMDS location offshore. Additionally, the action area will include any areas upstream of the project that experience changes in salinity, or approximately 3 miles south of “The Tee” (Figure 7), with the red line denoting the upper extent of the action area. The full extent of the action area is shown in Figure 7.

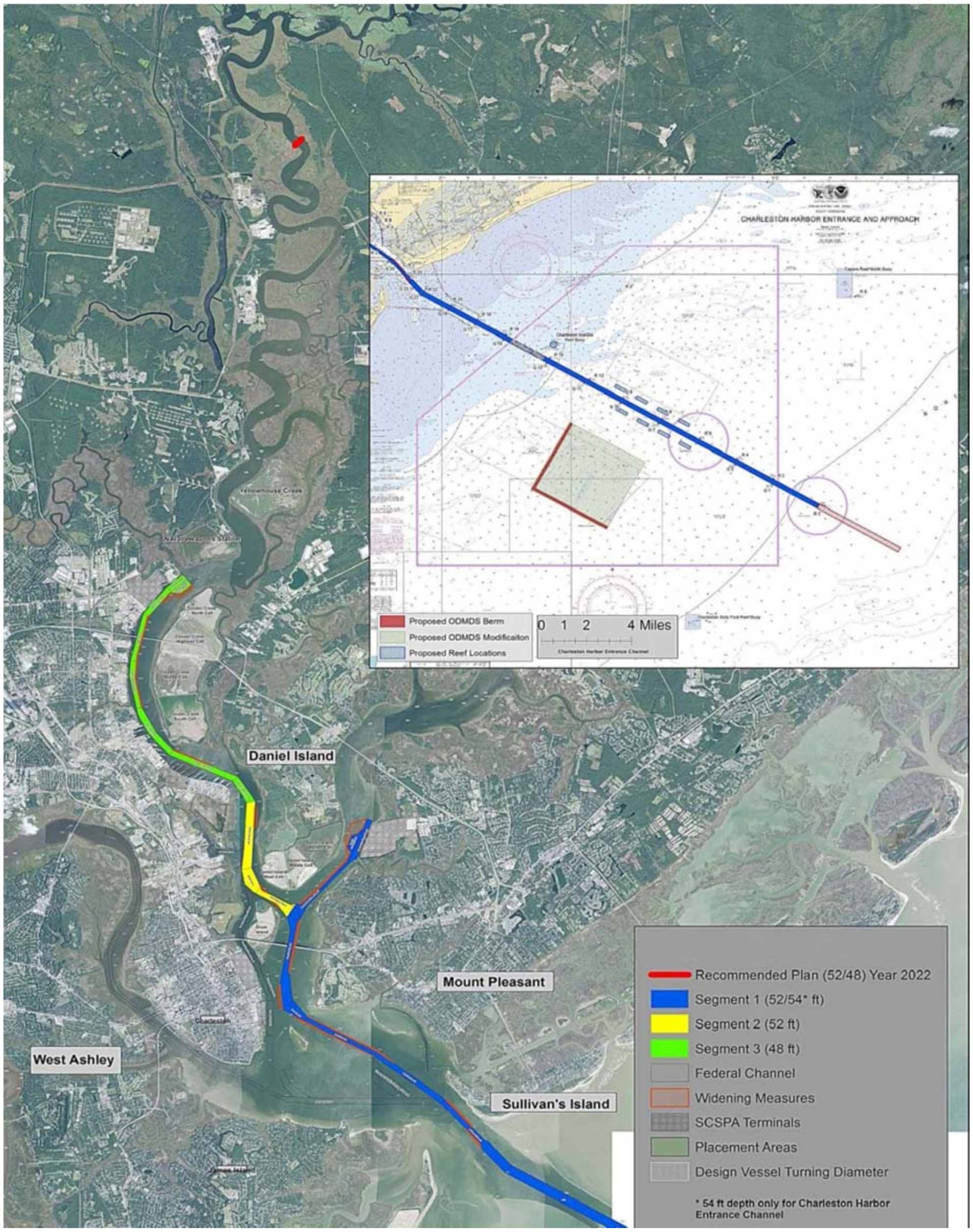


Figure 7. The action area of the project (USACE 2014)

3 STATUS OF SPECIES AND CRITICAL HABITATS

Listed species occurring within the action area that may be affected by the proposed action are itemized in Table 3 with their respective scientific names and status. The action area includes proposed designated critical habitat for the North Atlantic right whale.

Table 3. Status of Listed Species in the Action Area

Common Name	Scientific Name	ESA Listing Status[9]
Turtles		
Green	*Chelonia mydas*[10]	E/T
Kemp's ridley	*Lepidochelys kempii*	E
Loggerhead	*Caretta caretta*[11]	T
Hawksbill	*Eretmochelys imbricata*	E
Leatherback	*Dermochelys coriacea*	E
Fish		
Shortnose sturgeon	*Acipenser brevirostrum*	E
Atlantic sturgeon	*Acipenser oxyrinchus*[12]	E
Marine Mammals		
North Atlantic right whale	*Eubalaena glacialis*	E
Humpback whale	*Megaptera novaeangliae*	E
Critical Habitat		
North Atlantic right whale, Unit 2	Proposed for Designation February 20, 2015 (NMFS 2015)	Proposed

3.1 Analysis Species and Critical Habitats Not Likely to be Adversely Affected

We have determined that the proposed action being considered in this Opinion is not likely to adversely affect the North Atlantic right whale, its designated or proposed critical habitat, humpback whale, shortnosed sturgeon, leatherback sea turtles, and hawksbill sea turtles. These species are excluded from further analysis and consideration in this Opinion. The following discussion summarizes our rationale for this determination.

3.1.1 North Atlantic Right Whale

Year round, right whales can be found from Cape Cod to Nova Scotia, an area the whales use for feeding and mating. Each fall, pregnant females and others travel from this area to their only known calving area in the warm, calm coastal waters off the Southeast Atlantic Bight (SAB) which extends roughly from Cape Hatteras, North Carolina, to West Palm Beach, Florida. Recent information reveals the South Carolina coast to be part of this calving area, including the waters surrounding the Port of Charleston (Good 2008). Non-calving whales are moving between habitats continuously during the calving season (B. Zoodsma, NMFS, pers. comm. to K. Reece, NMFS, January 29, 2015). When spring arrives, the whales make the long journey back north. Aerial survey data shows regular observations or these whales off the Port of Charleston (Figure 8). Sightings off the Southeast Atlantic Coast include primarily adult females and calves, but juveniles and adult males are also commonly observed. Annual right whale migration

[9] E = Endangered, T = Threatened
[10] Green turtles are listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are listed as endangered.
[11] NWA DPS
[12] River and in-shore habitats within the action area may affect Atlantic sturgeon from the Carolina and South Atlantic DPS; however, Atlantic sturgeon from all DPS may be affected in off-shore waters within the action area.

past the CHP45 action area (both to and from) as well as the use of calving grounds off the southeastern U.S. coast occurs from November 1 through April 30.

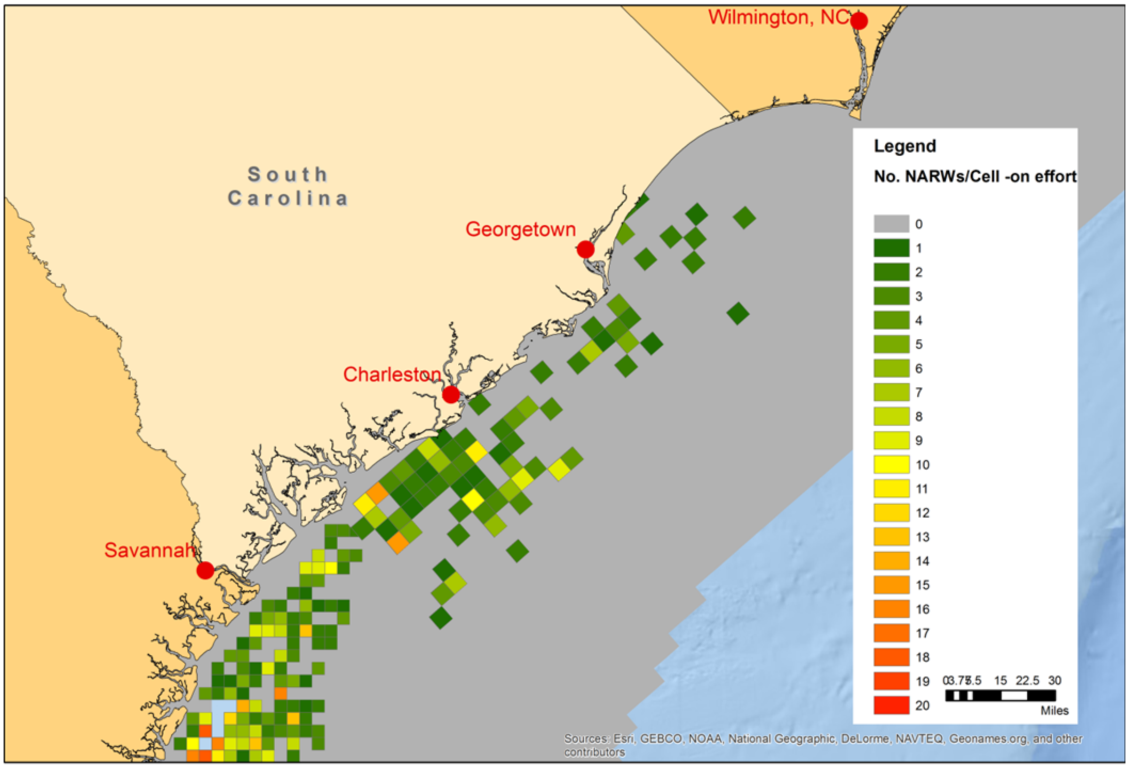


Figure 8. Cumulative North Atlantic Right Whale sightings in 3 x 3 nmi and 4.06 x 4.06 nmi grid cells for 2004/2005 through 2012/2013 seasons in the southeast United States. (Source: North Atlantic Right Whale Consortium, unpublished data and analysis by Florida Fish and Wildlife Conservation Commission)

Ship collisions caused 38% of confirmed right whale deaths from 1985-2005 (Kraus et al. 2005). Seven percent of the population exhibit scars indicative of additional, nonlethal vessel interactions (Kraus 1990). In 2011, of 4 deceased right whales encountered, half were associated with rope entanglement, 1 had multiple skull and vertebral fractures that are consistent with ship strike, and a fourth was found floating offshore with no evidence of entanglement. In January 2011, a live right whale was observed with approximately 14 propeller cuts across its body; it had been observed 5 days earlier with no injuries.

Various types and sizes of vessels have been involved in ship strikes with large whales, including container/cargo ships/freighters, tankers, steamships, U.S. Coast Guard vessels, Navy vessels, cruise ships, ferries, recreational vessels, fishing vessels, whale-watching vessels, and other vessels (Jensen and Silber 2003d). In March 2008, a 43-ft vessel traveling at 18-19 knots (20.7-21.86 mph) struck and seriously injured an adult female right whale, Eg No. 2324, about 8 nmi off the north end of Cumberland Island, Georgia (George and Naessig 2006; Zoodsma 2005). This animal was last seen in September 2005 when she was spotted in Massachusetts Bay in exceptionally poor health (Waring et al. 2012) and is now presumed dead. In May 2009, a 33.7-ft vessel reportedly struck and killed a 21.3-ft southern right whale calf in New South Wales, Australia (NSWNPS 2009).

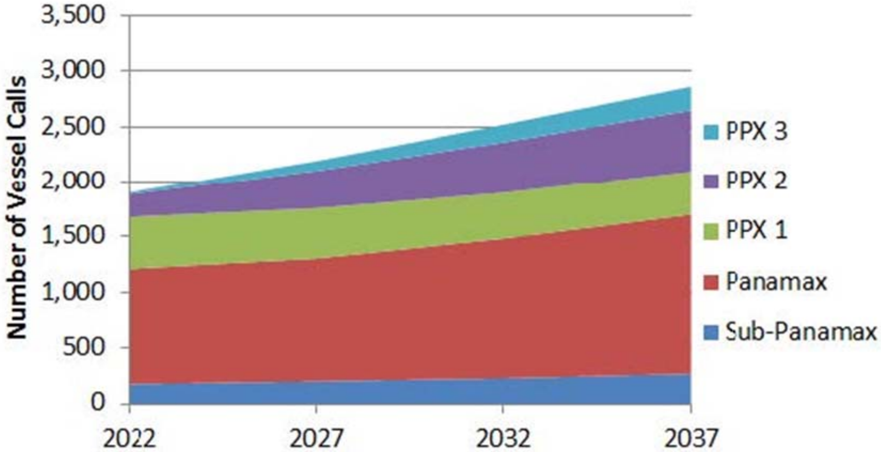
Records of right whale ship strikes (Knowlton and Kraus 2001) and large whale ship-strike records (Jensen and Silber 2003a; Laist et al. 2001) have been compiled, and all indicate vessel speed is a principal factor in ship strikes. In assessing records in which vessel speed was known, Laist et al. (2001) found "a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision." The authors concluded that most deaths occurred when a vessel was traveling in excess of 14 knots. Jensen and Silber (2003) identified 292 records of known or probable ship strikes of all large whale species from 1975-2002. In 58 of the records, ship speed at the time of collision was known: Speed ranged from 2-51 knots, with an average of 18.1 knots. A majority (79%) of ship strikes occurred at speeds of 13 knots or greater. Of the 58 cases where speed was known, 19 (32.8%) resulted in serious injury to the whale. The mean vessel speed that resulted in serious injury or death to the whale was 18.6 knots (Jensen and Silber 2003a).

Using a total of 64 records of ship strikes in which vessel speed was known, Pace and Silber (2005) tested speed as a predictor of the probability of death or serious injury. The authors concluded that there was strong evidence that the probability of death or serious injury increased rapidly with increasing speed. Specifically, the predicted probability of serious injury or death increased from 45% to 75% as vessel speed increased from 10 knots to 14 knots, and exceeded 90% at 17 knots. Interpretation of the logistic regression curve (Jensen and Silber 2003a) implies injury or death at around 25 knots and faster. In a related study, Vanderlaan and Taggart (2007) analyzed all published historical data on vessels striking large whales. The authors found that the probability of a lethal injury resulting from a strike ranged from 20% at 9 knots to 80% at 15 knots and 100% at 21 knots or more.

Related studies of the occurrence and severity of strikes relative to vessel speed have been conducted for other species and locations. Panigada et al. (2006) concluded that vessel speed restrictions and the relocation of vessel routes in high cetacean density areas would reduce the likelihood of ship strikes of fin whales in the Mediterranean Sea. Speed zones were adopted in Florida in the early 2000s to reduce the numbers of collisions and manatee injuries resulting from collisions with boats. Laist and Shaw (2006) assessed the effectiveness of these speed zones at reducing watercraft-related manatee deaths. Watercraft-related manatee deaths did decline in the areas assessed in the paper, and the authors reported that this decline reflected the fact that well-designed speed restrictions could be effective if properly enforced. They further stated that "reduced speed allows time for animals to detect and avoid oncoming boats, and that similar measures may be useful for other marine mammal species vulnerable to collision impacts with vessels (e.g., North Atlantic right whales)" (Laist and Shaw 2006).

The behavior of whales in the path of approaching ships is uncertain, but in some cases, last-second flight responses may occur. If a whale attempts to avoid an oncoming vessel at the last minute, a burst of speed coupled with a push from the bow wave could mean that mere seconds might determine whether the whale is struck (Laist et al. 2001). A reduction in speed from 18 knots to 10 knots would give whales an additional 8.6 seconds (at a distance of 100 m) to avoid the vessel in this flight response scenario (Laist 2005, unpublished data). In a separate study involving whale behavior, Kite-Powell et al. (2007) developed a model that analyzed ship-strike risk with respect to vessel speed and whale avoidance behavior. The authors of the ship-strike analysis assert that ship-strike risk decreases as speed decreases and the distance that the whale detects the vessel increases. Assuming certain whale behavior, the model suggests that the ship-strike risk posed by a conventional ship (e.g., containership) traveling at 20-25 knots can be reduced by 30% at a speed of 12 or 14 knots, and by 40% at a speed of 10 knots, due to the whales' increased ability to detect and avoid approaching vessels. If a whale detects and reacts to an oncoming vessel at a distance of 820 ft (250 m) or greater, it will likely avoid a ship strike, whereas at detection distances less than 328 ft (100 m), the probability of ship strike is almost 100% at speeds of 15 knots or faster. However, research on vessel-whale collisions indicates that of 3 speeds considered—10, 12, and 14 knots—adopting a speed limit of 10 knots would be the most beneficial to the recovery of the right whale population. Historically, only a small percentage of ship strikes occurred at 10 knots, and those that did usually resulted in injury rather than death (Laist et al. 2001). Nonetheless, it is important to note of the 3 speeds considered above, while a 10-knot speed restriction is most effective at reducing the risk of ship strikes, it will not eliminate the risk; there is still a 45% predicted probability of serious injury or mortality at 10 knots (Pace and Silber 2005).

The proposed action allows for larger and more fully loaded vessels to call on the port. Larger ships currently experience transportation delays due to insufficient Federal channel depths in Charleston. To reach port terminals, these larger ships must either light load, experience delays while waiting for favorable tide conditions, or both, which require more vessels to carry the same amount of goods (USACE 2104). The construction of the TSP would result in larger ships with fewer ship transits because larger ships carry more goods, thus requiring a smaller number of ships to transport the same amount of goods. However, with the increasing demands for imported goods and materials it is projected that the port will continue to receive increasing vessel calls over time (Figure 9) (USACE 2014) even without this port deepening project. Separate from port-related vessel traffic, NMFS is expecting an increase in vessel traffic related to dredge activities transiting between the navigational channel and the disposal sites during the deepening project only. The DEIS (USACE 2014) states that the duration and frequency of dredging events would be within the range of the current practices, therefore, we anticipate maintenance dredging in the future to occur at a similar interval as it has in the past.



Vessel Class	2022	2027	2032	2037
Sub-Panamax	176	202	229	269
Panamax	1,035	1,103	1,255	1,434
PPX 1	470	456	416	392
PPX 2	206	342	460	555
PPX 3	16	89	161	214
Total	**1,903**	**2,192**	**2,520**	**2,863**

Figure 9. Expected vessel calls in the Port of Charleston (USACE 2014)[13]

During the construction of CHP45, NMFS-approved endangered species observers will be required to be present to watch for marine mammals during all daytime hopper dredging and any vessel transits from the CHP45 to the ODMDS locations that occur during the right whale migration/calving season as described in Section 2.1.3.2. Observers will reduce the chances of an inadvertent collision with a right whale by increasing the likelihood of detection of a right whale, which allows for more reaction time by both the vessel and the whale. Depending on the size of the vessel used, there will be an estimated 7,456 dredge trips during the project to dispose of the dredged material in the offshore disposal areas. Right whales occur in low densities and in irregular distribution within the SAB including the areas between the entrance channel and the disposal areas (B. Zoodsma, NMFS, personal communication to K. Reece, NMFS, January 29, 2015). Given their reduced numbers and irregular habitat usage patterns, it is unlikely that right whales will be adversely impacted by dredge-related vessel transits. The likelihood of interaction is further reduced by the precautions stipulated for vessel avoidance and the USACE proposed conservation measures (Section 2.1.3.2) of this Opinion, which require project-related vessels (i.e., dredges and towed or self-propelled barges) to abide travel no faster than 10-knots during right whale migration/calving season (November 1 thought April 30) while traveling in the Atlantic Ocean between dredging and disposal areas. NMFS believes that the conservation measures limiting vessel speeds during the right whale migration/calving season of no greater than 10 knots (no greater than 5 knots at night and during periods of limited visibility) will

[13] Containerships are classified as sub-Panamax, Panamax, Post-Panamax Generation I (PPX1), Post-Panamax Generation II (PPX2), and Generation III (PPX3)

reduce the chance of an inadvertent collision with a right whale by (1) significantly increasing the likelihood of detection of a right whale that may be in, near, or approaching the path of the vessel, (2) significantly increasing the watch stander's reaction time (i.e., the time between when she or he detects the whale and takes action to avoid it), and (3) significantly increasing the likelihood that the whale may detect the oncoming vessel and possibly move out of the way to avoid being struck by it. Thus, NMFS concludes that the project's vessel-related effects on North Atlantic right whales are discountable based on the rarity of the species and on the implementation of the suite of whale conservation measures discussed above

Entrance channel extension and the construction of reefs will not cause any habitat impacts that will impact the activities of right whales. While actual construction activities may cause a whale to move away, there are ample available habitats nearby. Given the slow speed and low number of individual dredge-related vessels right whales will not be prevented from moving about in or migrating through the area. Thus, construction impacts, the extension of the entrance channel, and the construction of reefs are considered insignificant to right whales.

3.1.2 North Atlantic Right Whale Proposed Critical Habitat

Modifications to designated critical habitat for the North Atlantic right whale were proposed on February 20, 2015. Critical habitat consists of specific areas on which are found those physical or biological features essential to the conservation of the species called essential features.

North Atlantic right whales are observed calving off the southeastern U.S. coast, in an area designated as Unit 2 of the proposed North Atlantic right whale critical habitat (Figure 10). The entrance channel, the ODMDS, and the offshore reef areas are located in Unit 2. The essential features of right whale calving habitat are calm sea surface conditions, sea surface temperature, and depth. These features are dynamic in their distributions throughout the SAB in that they vary over both time and space, and their variations do not necessarily correlate with each other. As such, calving right whales likely select areas containing varying combinations of the preferred ranges of the essential features available within the SAB, as identified previously, depending on factors such as the weather (e.g., storms, prevailing winds) and the age of the calves (e.g., neonate or more mature calf).

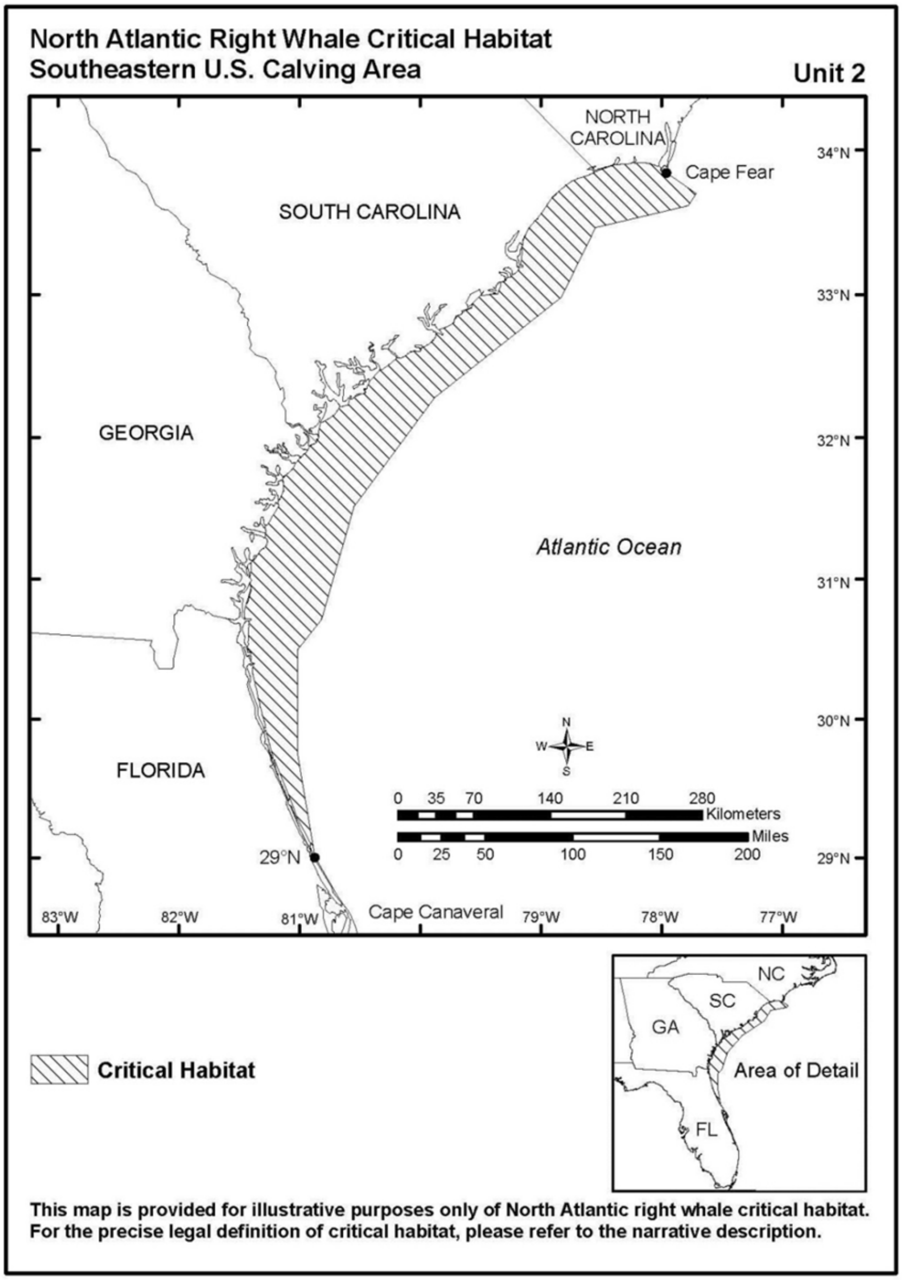


Figure 10. Proposed North Atlantic right whale critical habitat, Unit 2 (NMFS 2015)

Neither the dredging, related vessel operations, nor the disposal of dredged material will significantly impact water depth, sea surface conditions, or the temperature of the ocean. While the ODMDS and the reef mitigation sites will decrease water depths by as much as 10 ft, elevated sea bottom will not impede whales in any way. Water depths will still be sufficient for the animals to move freely throughout the habitat.

The likelihood of interaction which may impact the distribution of right whale calf/cow pairs is further reduced by the precautions stipulated for vessel avoidance. Thus, the proposed action will have insignificant effects on the physical and biological features (water depth, surface conditions, and water temperature), which were the bases for determining this habitat to be critical.

3.1.3 Humpback Whale

Humpback whales live in all major oceans from the equator to subpolar latitudes. They typically migrate between tropical/subtropical and temperate/polar latitudes. In the Atlantic Ocean, humpback whales feed in the northwestern Atlantic during the summer months and migrate to calving and mating areas in the Caribbean. They utilize 6 separate feeding areas in northern waters after their return. These areas are within the biologically important area defined by the 200-m isobath[14] on the North American east coast. These areas are outside of the project's potential impact area. The best available estimate for the number of individuals in the North Atlantic is 11,750 humpback whales. Recent estimates of abundance in the North Atlantic stock indicate continued population growth; however, the size of the humpback whale stock may be below the optimum sustainable population in the U.S. Atlantic Exclusive Economic Zone (Waring et al. 2014).

Humpback whales face many threats due to human activity. They may become entangled in fishing gear; either swimming away with the gear after entanglement or by becoming anchored by it. Inadvertent vessel strikes can injure or kill humpbacks. Whale watching vessels may harass, stress, or strike whales. Traffic through shipping channels, fisheries, and aquaculture may displace whales that normally aggregate in that area. Vessel speed limits (described in Section 2.1.3.2), and using dedicated observers will diminish the potential interactions between large whales and dredging equipment (NMFS 1997b). Thus, NMFS concludes that the project's vessel related effects on humpback whales are discountable based on the rarity of the species and on the implementation of the suite of whale conservation measures discussed above and in the RPMs of this Opinion.

3.1.4 Shortnose Sturgeon

The shortnose sturgeon is the smallest of the 3 sturgeon species that occur in eastern North America. They attain a maximum length of about 6 ft, and a weight of about 55 pounds. Shortnose sturgeon inhabit large coastal rivers of eastern North America. Although considered an anadromous species,[15] shortnose sturgeon are more properly characterized as "freshwater amphidromous," meaning that they move between fresh and salt water during some part of their life cycle, but not necessarily for spawning. Early life stages of shortnose sturgeon (eggs, larvae, and young-of-the-year) are extremely sensitive to salinity. Zeigeweid et al. (2008) conducted experiments on 66- to 144-day-old juvenile shortnose sturgeon between 0.4-42.8 grams in body weight. At those ages and weights, 50% of juvenile sturgeon died after a 48-hour exposure to salinities between 14.8 and 20.9 parts per thousand (ppt). Laboratory experiments conducted by Jenkins et al. (1993) showed that 76-day-old juvenile shortnose sturgeon experienced 100% mortality during a 96-hour exposure test to salinities equal to or greater than 15 ppt. However, 330-day-old sturgeon tolerated salinities up to 20 ppt for 18 hours, but 100% died when exposed to 30 ppt. Both studies found that salinity tolerance increased with age and body weight (Ziegeweid et al. 2008; Jenkins et al. 1993). There are no studies indicating that adult shortnose

[14] An isobaths is an imaginary line or a line on a map or chart that connects all points having the same depth below a water surface (as of an ocean, sea, or lake).
[15] One that lives primarily in marine waters and breeds in freshwater

sturgeon are sensitive to salinity. Shortnose sturgeon generally stay in the rivers where they were born ("natal rivers"), though recent research indicates they stray into non-natal (and sometimes non-adjacent) riverine systems via the marine environment more frequently than previously thought (Post et al. 2014; Zydlewski et al. 2011).

Southern populations of shortnose sturgeon usually spawn at least 125 miles (200 km) upriver (Kynard 1997) or throughout the fall line[16] zone, if they are able to reach it. Shortnose sturgeon found in the action area are unable to access the fall-line zone because of dams located along the river, the nearest being Pinopolis Dam, at River Mile (RM) 48. The dam has isolated the shortnose sturgeon population in the Cooper River, blocking upstream access to sturgeon below the Pinopolis Dam. Historically, telemetry studies have indicated that shortnose sturgeon do not pass upriver through the vessel lock in the Pinopolis Dam on the Cooper River. In 2012, however, 2 shortnose sturgeon were recorded travelling through the Pinopolis Lock and were later recorded in the Wateree and Congaree Rivers (B. Post, SCDNR, pers. comm. to K. Reece, NMFS, April 11, 2012).

The population of shortnose sturgeon downstream of Pinopolis have been documented in the tailrace area immediately below the dam since 1997 (Cooke and Leach 1999). Fertilized shortnose sturgeon eggs collected in the Pinopolis Dam tailrace verified spawning despite non-traditional spawning habitat (i.e., barren hard bottom with scattered pockets of clam shell and marl pieces) (Cooke and Leach 2004; Duncan et al. 2004). This spawning in the tailrace in atypical habitat supports the hypothesis that a blockage in spawning migration can force new spawning areas (Kynard et al. 1999). Kynard (1997) reported that for sturgeon spawning directly below a dam in tailrace flows, the facility's operation controls the suitability of water velocities for spawning and rearing of eggs and embryos. It is likely that the variable operation of the dam results in eggs being removed from the substrate by high velocity flows or being compromised due to the lack of adequate water and oxygen-providing aeration during low velocity flows. Cook and Leach (2004) reported that the tailrace of the Pinopolis Dam experiences a combination of tidal influence, highly variable discharge, high current velocities (alternating with no current), and limited spawning substrates which limit early-life survival.

Laboratory studies of larvae found most ceased downstream migration after only 2 days, though some continued for 14 (C. Cauthron & B. Kynard unpublished data). This timeframe is sufficient to move downstream but not sufficient to move to the estuary. Tolerance of early life stages to increasing salinity and low dissolved oxygen increases with age. Twenty- two day old larvae from the Savannah River tolerated a maximum of 9 ppt salinity and required more than 3 mg l-1 oxygen, while fish about 300 days old tolerated 25 ppt salinity for 18 hours and most survived short periods of 3 mg l-1 oxygen (Jenkins et al. 1993). No larvae have been found downstream of the Pinopolis Dam (B. Post, SCDNR, pers. comm. to K. Reece, NMFS, April 14, 2015). However, any eggs that made it to the larval stage would not be viable because of exposure to salinity downstream of the dam. Larvae would not have enough time to mature to a stage that was tolerant of increased estuarine salinities. Typical spawning occurs further upriver allowing sufficient time for larvae to develop increased salinity tolerances. No known collections of early life-stage shortnose sturgeon, other than fertilized in the tailrace, have been

[16] The fall line is the boundary between an upland region of continental bedrock and an alluvial coastal plain, sometimes characterized by waterfalls or rapids.

made to date with limited survey efforts. The absence of early life stage shortnose sturgeon indicates that recruitment failure is occurring as smaller fish are not present to grow and replace the reproducing adults. This finding led Cooke and Leach (2004) to determine that the Cooper River subpopulation of shortnose sturgeon is recruitment-limited. Thus, the status quo does not allow for shortnose sturgeon eggs to develop into fry that subsequently mature into adult sturgeon. The CHP45 project will not alter these current conditions faced by early life stage shortnose sturgeon and will not change their likelihood of survival.

Recent research conducted from 2011-2014 documented 40 shortnose sturgeon that were detected by a receiver in the Cooper River moving as far upstream as the Pinopolis Dam (RM 48) and as far downstream as RM 0 (Post et al. 2014) with only 3 shortnose sturgeon (all adult) observed in the Wando River (B. Post, SCDNR, pers. comm. to K. Reece, NMFS, April 8, 2015). All 40 of these sturgeon demonstrated upstream and downstream movements with movement patterns that were similar over each year of the study period (Post et al. 2014). Shortnose sturgeon that were tagged in other waterbodies (the Great Pee Dee and Edisto Rivers in South Carolina and another tagged in North Carolina waters) occupied the same freshwater water tidal zone, but they did not make presumed spawning runs to Pinopolis Dam and were never detected upstream of RM 28.148. Prior research carried out by Palmer (2001) found shortnose sturgeon migrated seasonally within a 25.4-mile stretch of the river between the Pinopolis Dam at RM 48 and the Naval Weapons Station at about RM 22.6 (Palmer 2001)(Table 4). In the winter, the shortnose sturgeon aggregate around RM 27; this structurally diverse area is thought to be a productive foraging site and to provide shelter to the fish from high river flow (Palmer 2001). Direction of shortnose sturgeon movement was not affected by tidal flow (Palmer 2001). Direction of movement by shortnose sturgeon is also independent of tidal flow in the Altamaha and Cape Fear Rivers (Collins et al. 2000a; Moser and Ross 1995).

Shortnose sturgeon do not frequently utilize the lower 22 miles (approximate) of the Cooper River (Palmer 2001). This area between the Naval Weapons Station (about RM 22) and Charleston Harbor is dredged about every 18 months (removing ~ 1 MCY) to allow safe passage of deep-draft vessels, thereby removing substrate and prey. Therefore, the shortnose sturgeon in the Cooper River exist in an abbreviated ecosystem: available habitat is restricted within the upper 26 miles of the Cooper River between Pinopolis Dam at RM 48 and about RM 22. Sturgeon were tagged and tracked by Palmer (2001) in the Cooper River by season and River Mile. Pinopolis Dam is located at RM 48.0 and provides a barrier to upstream movement. The Naval Weapons Station is at about RM 22.

Table 4. Seasonal Distribution of 14 Shortnose Sturgeon

Season	**River Mile**
Spring	25.5-48.0
Summer	30.6-48.0; primarily 44.2-45.9 and 39.4-41.4
Fall	27.2-48.0
Winter	22.6-48.0

Shortnose sturgeon are not expected to be in the entrance channel in the Atlantic ocean where hopper dredging will occur. NMFS has previously determined in Opinions evaluating the effects of dredging that, while oceangoing hopper-type dredges may lethally entrain protected species, non-hopper type dredging methods (e.g., mechanical, clamshell or bucket dredging, hydraulic cutterhead dredges) are slower and unlikely to overtake or adversely affect them. As well, taking by mechanical dredges appears to be exceedingly rare with none observed occurring in the Charleston area. Thus, NMFS concludes that the project's dredge related physical effects on shortnose sturgeon are discountable based on the rarity of the species in the project area, hopper dredging will not be used in areas where Atlantic sturgeon are likely to occur, and the lack of observed sturgeon takes resulting from mechanical and hydraulic cutterhead dredging near the CHP45 project area.

The proposed channel deepening will increase the salinity concentrations in the action area. The Environmental Fluid Dynamics Code[17] (EFDC) model predicted salinity changes resulting from the project. Figure 11 depicts the overall changes in salinity that are predicted the result from the proposed action. The greatest changes in salinity are projected in the Wando River. However, shortnose sturgeon rarely utilize the Wando River (B. Post, SCDNR, pers. comm. to K. Reece, NMFS, April 8, 2015), and those that do are adults and not sensitive to variations in salinity. Based on information in the DEIS, all projected salinity increases in the Cooper River will be less than one ppt, with the average change estimated to be less than 0.40 ppt. Additionally, in the upper Cooper River (where younger, less salt tolerant shortnose sturgeon would be found), the model results indicate no salinity increase is projected during average weather/climatic conditions. In the extreme climatic conditions such as drought (99% exceedance) the projected salinity increases in the upper river are projected to be 0.25 ppt or less. Finally, results indicate the location of the Cooper River brackish-freshwater transition zone will move approximately one-half mile upstream shown in Figure 12. Due to the very small magnitude of the anticipated changes in salinity throughout portions of the action area which are used by shortnose sturgeon, and the related conclusion that the effects will not alter the current conditions that already impede successful recruitment, we anticipate that any direct effects to shortnose sturgeon will be insignificant.

[17] The Environmental Fluid Dynamics Code is a state-of-the-art hydrodynamic model that can be used to simulate aquatic systems in one, two, and three dimensions.

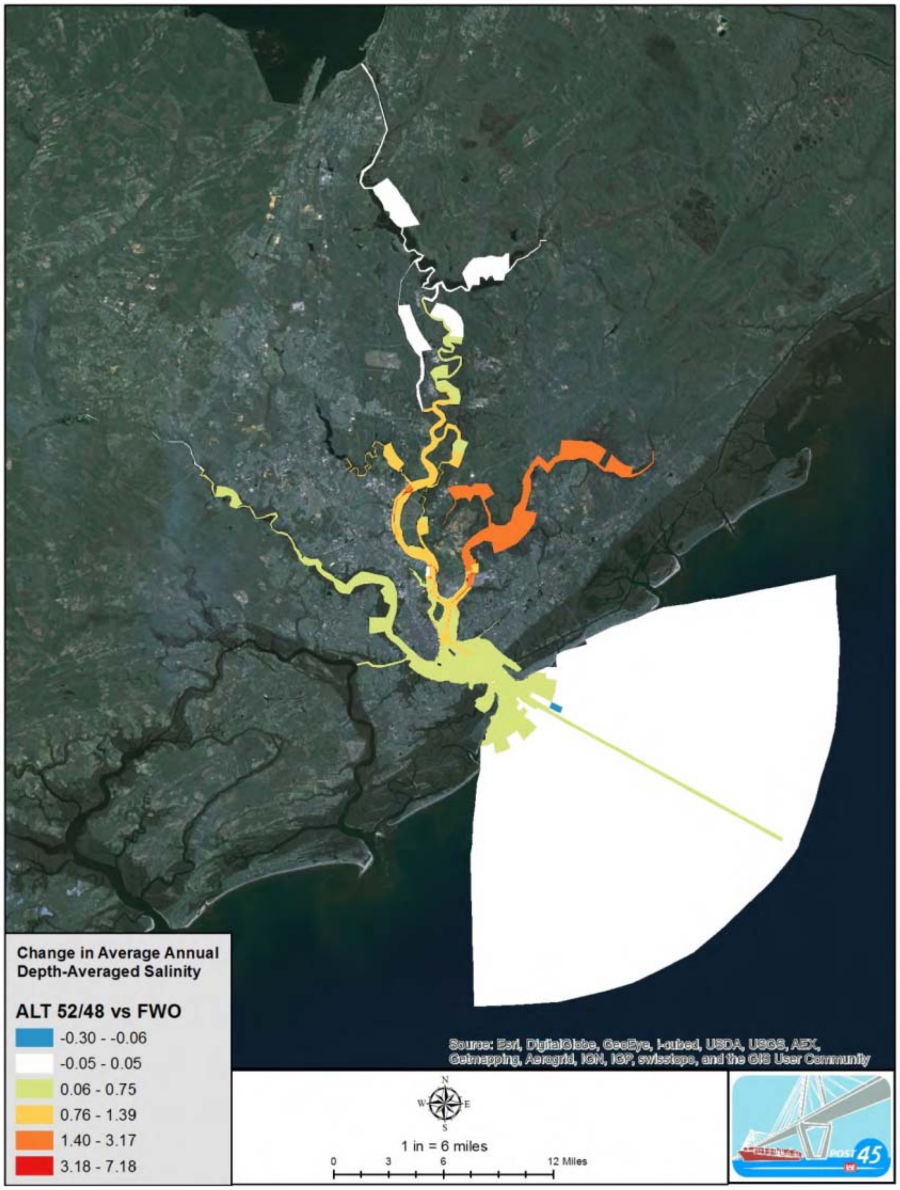


Figure 11. Changes in Average Annual Salinity Predicted to Result from the Proposed Action (USACE 2014).

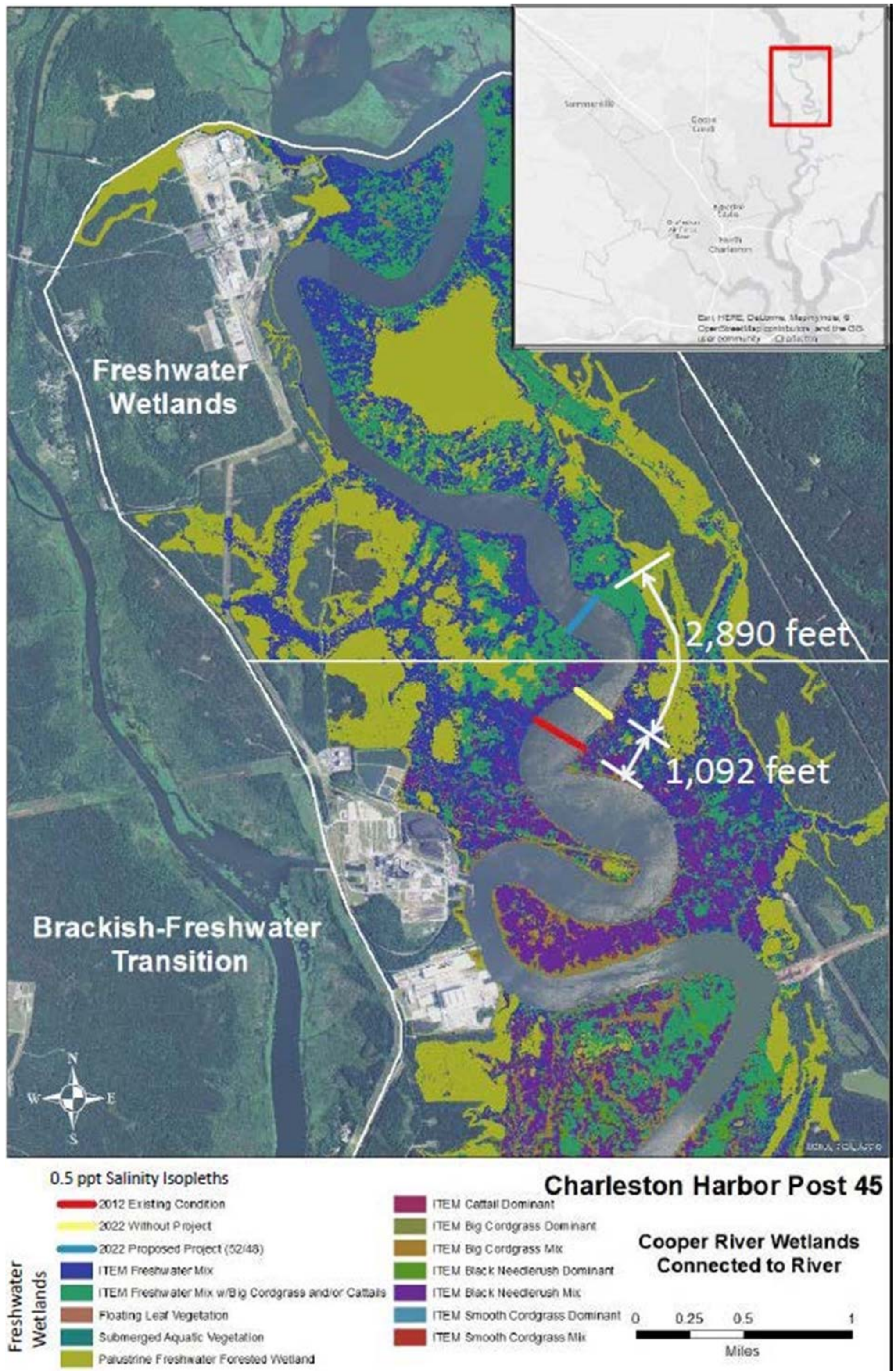


Figure 12. Projected upriver movement of the brackish-freshwater transition in the Cooper River following the CHP45 project (USACE 2014).

The proposed channel deepening may also have an effect on dissolved oxygen (DO). The current average DO level in the Cooper River is 5.77 mg/L. Overall, the current values in the river range from average low values of 4.7 mg/L to average high levels of 7.6 mg/L. None of the data for the current conditions indicates any DO levels in the Cooper River less than 4.4 mg/L. The EFDC model was used to forecast future effect of the proposed project combined with the effects of all anticipated discharges to predict all future changes in DO. The model results indicate very minor DO reductions throughout the action area (average reduction of 0.03mg/L). Additionally, this analysis indicates that the combined effect of the proposed project with on-going and future unrelated discharges would result in Cooper River DO reductions ranging from less than 0.02 mg/L to 0.1256 mg/L. The average anticipated total DO reduction in the areas occupied by shortnose sturgeon (i.e., above mile 20) is less than 0.03 mg/L. Due to the very small magnitude of the anticipated changes in DO throughout portions of the action area which are used by shortnose sturgeon, we anticipate that any direct effects to shortnose sturgeon will be insignificant.

In order to better understand the implications of deepening the harbor on fishery habitats, the USFWS Habitat Suitability Index (HSI) models for representative species were applied in order to evaluate effects of project alternatives (USACE 2014). These models assess potential changes to habitat quantity and quality. The model results indicate that the quantity of suitable shortnose sturgeon foraging habitat is projected to slightly increase from about 20,977 acres to 21,017 acres. Foraging habitat quality is affected by substrate, velocity, and temperature in the model. Since substrate stays constant outside of dredged areas, velocity, and temperature become the influencing variables. Since the bottom temperatures are slightly lower in the alternative conditions compared to the FWOP, temperature positively benefits shortnose sturgeon foraging in the HSI within many cells, and negatively in fewer cells. The anticipated changes in habitat quality (i.e., HSI) are projected to be very small. The combined effect of increased quantity and minor qualtitative changes result in a projected net 0.19% increase in habitat units from the proposed project when compared to the future without project (FWOP) condition (USACE 2014). Results of HSI modeling indicate that shortnose sturgeon foraging habitat will not be adversely affected by the proposed project.

The CHP45 project includes enlarging existing turning basins. The Wando Welch, Navy base, and North Charleston Terminal turning basin will all be expanded to accommodate Post Panamax Generation II and Generation III container ships. All 3 terminals are located in the bottom 13 miles of the Cooper and in the Wando River. Impacts from enlarging the turning basins are limited to temporary loss of prey species as a result of dredging operations disturbing sediments in the areas. This effect is considered insignificant for shortnose sturgeon because these fish do not regularly utilize the Wando River or the lower 22 miles (approximate) of the Cooper River (Palmer 2001).

The elevation of dikes around upland disposal areas will impact a very small portion of tidal fringing saltmarsh at the southern end of Daniel Island across from the Wando Welch Terminal. Impacts from elevating the existing dikes considered insignificant for Shortnose sturgeon because these fish do not utilize the Wando River or the lower 22 miles (approximate) of the Cooper River (Palmer 2001).

3.1.1 Leatherback Sea Turtle

Leatherback sea turtles may be found in the action area, particularly when onshore winds and/or currents push jellyfish, their preferred prey, into inshore waters. However, leatherbacks are primarily a pelagic species, preferring deeper waters than those of the action area (the deepest portions of the offshore action area are less than 60 feet deep). Furthermore, in over 30 years of NMFS consultations with the USACE on hopper dredging projects carried out in the Charleston Harbor area, there has never been a documented take of a leatherback sea turtle by a hopper dredge. Because of this and their very large size (compared to hopper dredge dragheads or mechanical dredge equipment), pelagic nature (surface and mid-water), preference for deeper waters located beyond the project area further offshore, and feeding habits (which make it unlikely they would ever encounter a bottom-hugging hopper dredge draghead), NMFS believes the possibility that they would be adversely affected by a hopper dredge is discountable.

3.1.2 Hawksbill Sea Turtle

With respect to the United States, nesting occurs in Puerto Rico, the U.S. Virgin Islands, and along the southeast coast of Florida. Outside of the nesting areas, hawksbills have been seen off the U.S. Gulf of Mexico states and along the Eastern Seaboard as far north as Massachusetts, although sightings north of Florida are rare (NMFS and USFWS 1993). They are closely associated with coral reefs and other hard-bottom habitats, but they are also found in other habitats including inlets, bays, and coastal lagoons (NMFS and USFWS 1993). The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan 1999). During the past 30 years of NMFS consultations with the USACE on hopper dredging projects carried out in the Charleston Harbor area there has never been a documented take of a hawksbill sea turtle by a hopper dredge.[18] Due to hawksbill sea turtles' preferred habitat and diet, it is considered extremely unlikely that the species would be encountered in the action; therefore, NMFS believes the possibility that they would be adversely affected is discountable.

3.2 Status of Species Likely to be Adversely Affected

The following discussion focuses on the species of sea turtles and sturgeon that NMFS believes are likely to be adversely affected by the proposed action. The sea turtle subsections focus primarily on the natural history of Atlantic Ocean populations of these species because these are the populations that may be directly affected by the proposed action. As sea turtles are highly migratory, potentially affected species in the action area may make migrations in other areas of the Gulf of Mexico, Atlantic Ocean, and Caribbean Sea. The following subsections are synopses of the best available information on the life history, distribution, population trends, and current status of the 3 species of sea turtles that are likely to be adversely affected by 1 or more components of the proposed action. Additional background information on the status of sea turtle species can be found in a number of published documents: recovery plans for the Atlantic green sea turtle (NMFS and USFWS 1991b), Kemp's ridley sea turtle (NMFS and USFWS 1992), and loggerhead sea turtle (NMFS and USFWS 2008b); and status reviews, stock assessments, and biological reports (NMFS-SEFSC 2001; NMFS-SEFSC 2009e; NMFS and USFWS 1995; NMFS and USFWS 2007a; NMFS and USFWS 2007m; NMFS and USFWS 2007q; NMFS and USFWS 2007v; NMFS and USFWS 2007w; TEWG 1998; TEWG 2000a; TEWG 2007; TEWG 2009).

[18] USACE Sea Turtle Data Warehouse: http://el.erdc.usace.army.mil/seaturtles/index.cfm

3.2.1 Loggerhead

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 designating 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 population that occurs within the action area and therefore 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 centimeters [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 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 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 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 (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 2000b); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS-SEFSC 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 2008b). 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[19]), (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 2001b). 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 1988) which incubate for 42-75 days before hatching (NMFS and USFWS 2008b). Loggerhead hatchlings are 1.5-2 in long and weigh about 0.7 ounces (20 grams).

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 in (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

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

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, and 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, 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 the north coast of Cuba (A. Bolten and K. Bjorndal, University of Florida, unpublished data). Moncada et al. (2010) report the recapture in Cuban waters of 5 adult female loggerheads originally flipper-tagged in Quintana Roo, Mexico, indicating 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 2001; NMFS-SEFSC 2009a; NMFS and USFWS 2008b; TEWG 1998; TEWG

2000b; 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 2008b). NMFS and USFWS (2008b) 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.

Peninsular Florida Recovery Unit

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 1989-2007 showed an average of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (NMFS and USFWS 2008b). The statewide estimated total for 2013 was 77,975 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 13). FWRI performed a detailed analysis of the long-term loggerhead index nesting data (1989-2013) (http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/). Over that time period, 3 distinct trends were identified. From 1989-1998 there was a 30% increase that was then followed by a sharp decline over the subsequent decade. Large increases in loggerhead nesting occurred since then. FWRI examined the trend from the 1998 nesting high through 2013 and found the decade-long post-1998 decline had reversed and there was no longer a demonstrable trend. Looking at the data from 1989 through 2014 (an increase of over 32%), FWRI concluded that there was an overall positive change in the nest counts (http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/).

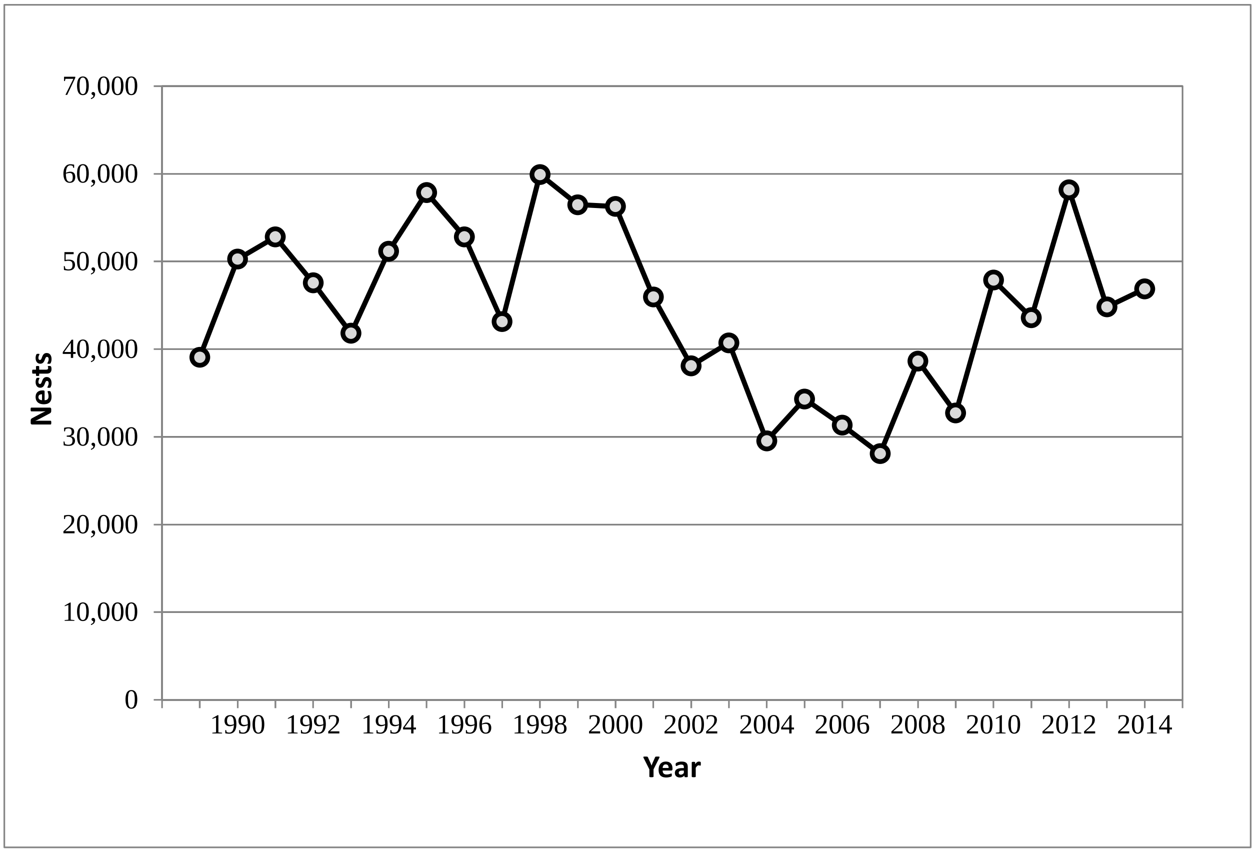


Figure 13. Loggerhead sea turtle nesting at Florida index beaches since 1989

Northern Recovery Unit

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 5 showing data from GADNR, SCDNR, and NCWRC nesting datasets) 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 show a shift away from the declining trend of the past.

Table 5. Total Number of NRU Loggerhead Nests

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

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, with 2012 showing the highest index nesting total since the start of the program (Figure 14).

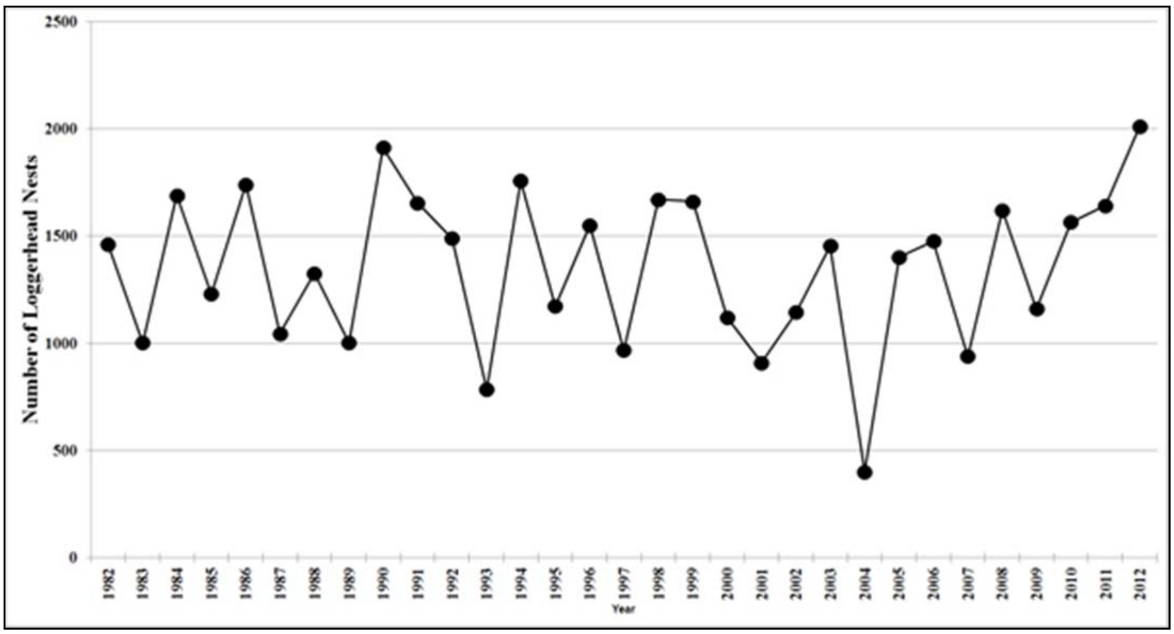


Figure 14. South Carolina index nesting beach counts for loggerhead sea turtles (from the SCDNR website, http://www.dnr.sc.gov/seaturtle/nest.htm)

<u>Other NW Atlantic DPS Recovery Units</u>

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 2008b). 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 2008b). 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 2008b).

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 (2008b), 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 2009a). 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 to 40,000 individuals, with a low likelihood of being up to 70,000 (NMFS-SEFSC 2009a). 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 2009a). 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) (NEFSC 2011).

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 and will not be repeated for Green (section 3.2.3) or Kemp's Ridley (Section 3.2.4). 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 1991b; NMFS and USFWS 1992; NMFS and USFWS 1993; NMFS and USFWS 2008a; 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 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; Crouse 1999). 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 1997a). 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 oil rig affected sea turtles in the Gulf of Mexico. There is an on-going assessment of the long-term effects of the spill on Gulf of Mexico marine life, including sea turtle populations. 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. Approximately 536 live adult and juvenile sea turtles were recovered from the Gulf and brought into rehabilitation centers; of these, 456 were visibly oiled (these and the following numbers were obtained from http://www.nmfs.noaa.gov/pr/health/oilspill/). To date, 469 of the live recovered sea turtles have been successfully returned to the wild, 25 died during rehabilitation, and 42 are still in care but will hopefully be returned to the wild eventually.

During the clean-up period, 613 dead sea turtles were recovered in coastal waters or on beaches in Mississippi, Alabama, Louisiana, and the Florida Panhandle. As of February 2011, 478 of these dead turtles had been examined. Many of the examined sea turtles showed indications that they had died as a result of interactions with trawl gear, most likely used in the shrimp fishery, and not as a result of exposure to or the ingestion of oil.

During the spring and summer of 2010, nearly 300 sea turtle nests were relocated from the northern Gulf to the east coast of Florida with the goal of preventing hatchlings from entering the oiled waters of the northern Gulf. From these relocated nests, 14,676 sea turtles, including 14,235 loggerheads, 125 Kemp's ridleys, and 316 greens, were ultimately released from Florida beaches.

A thorough assessment of the long-term effects of the spill on sea turtles has not yet been completed. However, 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. The population level effects of the spill and associated response activity are likely to remain unknown for some period into the future.

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 2007q). 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 2007q).

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 1990). 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 2007q). 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, etc.) could influence the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish, etc.) 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 2008b).

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.

Threats (Specific to Loggerhead Sea Turtles)

The threats faced by loggerhead sea turtles are well-summarized in the general discussion of threats in the Section above. 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).

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).

3.2.2 Green Sea Turtle

The green sea turtle was 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.

Species Description and Distribution

The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 pound (lb) (159 kg) and 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 and USFWS 1997). The 2 largest nesting populations are found at Tortuguero, on the Caribbean coast of Costa Rica, and Raine Island, on the Pacific coast of Australia along the Great Barrier Reef.

Differences in mitochondrial Deoxyribonucleic Acid (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. Such mixing occurs at extremely low levels in Hawaiian foraging areas, perhaps making this central Pacific population the most isolated of all green sea turtle populations occurring worldwide (Dutton et al. 2008).

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; Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon system in Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward Counties (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.

The complete nesting range of green sea turtles within the southeastern United States includes sandy beaches between Texas and North Carolina, as well as the U.S. Virgin Islands and Puerto

Rico (Dow et al. 2007; NMFS and USFWS 1991b). Still, 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. For more information on green sea turtle nesting in other ocean basins, refer to the 1991 publication, *Recovery Plan for the Atlantic Green Turtle* (NMFS and USFWS 1991b) or the 2007 publication, *Green Sea Turtle 5-Year Status Review* (NMFS and USFWS 2007a).

*Life History Informati*on

Green sea turtles reproduce sexually, and mating occurs in the waters off nesting beaches. 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 1989). 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 1989). 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 anthropogenic 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) (Campbell 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 2007m). Green sea turtles exhibit particularly slow growth rates of about 0.4-2 in (1-5 cm) per year (Green 1993; McDonald-Dutton and Dutton 1998), 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 and USFWS 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, with some post-nesting turtles also residing in Bahamian waters as well (NMFS and USFWS 2007m).

Status and Population Dynamics
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 is provided in the most recent 5-year status review for the species (NMFS and USFWS 2007m) organized by ocean region (i.e., Western Atlantic Ocean, Central Atlantic Ocean, Eastern Atlantic Ocean, Mediterranean Sea, Western Indian Ocean, Northern Indian Ocean, Eastern Indian Ocean, Southeast Asia, Western Pacific Ocean, Central Pacific Ocean, and Eastern Pacific Ocean). It shows trends at 23 of the 46 nesting sites: 10 appeared to be increasing, 9 appeared to be stable, and 4 appeared to be decreasing. With respect to regional trends, the Pacific, the Western Atlantic, and the Central Atlantic regions appeared to show more positive trends (i.e., more nesting sites increasing than decreasing) while the Southeast Asia, the Eastern Indian Ocean, and possibly the Mediterranean Sea regions appeared to show more negative trends (i.e., more nesting sites decreasing than increasing). These regional determinations should be viewed with caution, because trend data were only available for about half of the total nesting concentration sites examined in the review and site specific data availability appeared to vary across all regions.

The Western Atlantic region (i.e., the focus of this Opinion) was one of the best performing in terms of abundance in the entire review, as there were no sites that appeared to decrease. The 5-year status review for the species reviewed the trend in nest count data for each identified 8 geographic areas considered to be primary sites for green sea turtle nesting in the Atlantic/Caribbean (NMFS and USFWS 2007a): (1) Yucatán Peninsula, Mexico; (2) Tortuguero, Costa Rica; (3) Aves Island, Venezuela; (4) Galibi Reserve, Suriname; (5) Isla Trindade, Brazil; (6) Ascension Island, United Kingdom; (7) Bioko Island, Equatorial Guinea; and (8) Bijagos Achipelago, Guinea-Bissau. Nesting at all of these sites was considered to be stable or increasing with the exception of Bioko Island and the Bijagos Archipelago where the lack of sufficient data precluded a meaningful trend assessment for either (NMFS and USFWS 2007a). Seminoff (2004) likewise reviewed green sea turtle nesting data for 8 sites in the western, eastern, and central Atlantic, including all of the above with the exception that nesting in Florida was reviewed in place of Isla Trindade, Brazil. Seminoff (2004) concluded that all sites in the central and western Atlantic showed increased nesting, with the exception of nesting at Aves Island, Venezuela, while both sites in the eastern Atlantic demonstrated decreased nesting. These sites are not inclusive of all green sea turtle nesting in the Atlantic; however, other sites are not believed to support nesting levels high enough that would change the overall status of the species in the Atlantic (NMFS and USFWS 2007a). More information about site-specific trends for the other major ocean regions can be found in the most recent 5-year status review for the species (see NMFS and USFWS (2007a).

By far, the largest known nesting assemblage in the western Atlantic region occurs at Tortuguero, Costa Rica. According to monitoring data on nest counts, as well as documented emergences (both nesting and non-nesting events), there appears to be an increasing trend in this nesting assemblage since monitoring began in the early 1970s. 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). More recently, green sea turtle nesting has occurred in North Carolina on Bald Head Island, just east of the mouth of the Cape Fear River, on Onslow Island, and on Cape Hatteras National Seashore. In 2010, a total of 18 nests were found in North Carolina, 6 nests in South Carolina, and 6 nests in Georgia (nesting databases maintained on www.seaturtle.org).

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 15). According to data collected from Florida's index nesting beach survey from 1989-2012, 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 25,553 in 2013. Two consecutive years of nesting declines in 2008 and 2009 caused some concern, but this was followed by increases in both 2010 and 2011, a decrease in 2012, and another increase in 2013 (Figure 15). 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%.

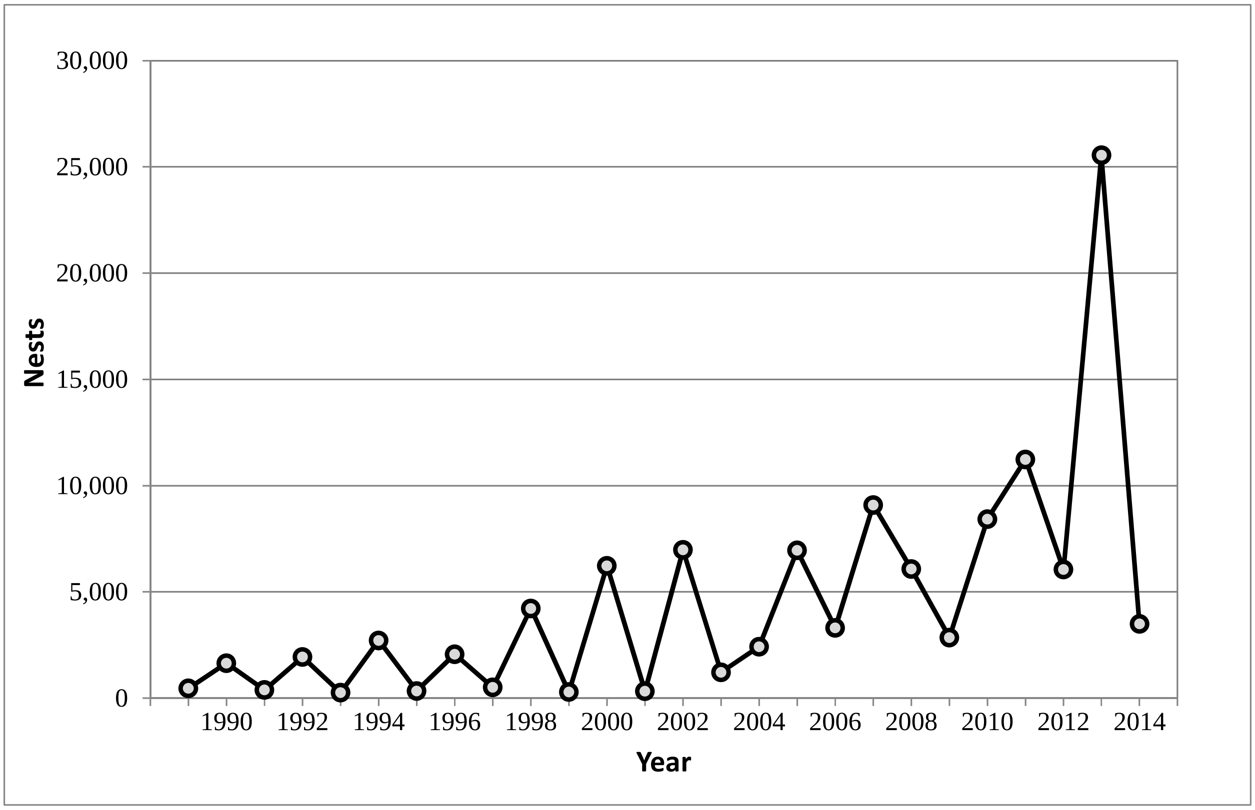


Figure 15. Green sea turtle nesting at Florida index beaches since 1989

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 3.2.1, with the heading *General Threats Faced by All Sea Turtle Species*

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). Presently, 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°F-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 1989). During January 2010, an unusually large cold-stunning event in the southeastern United States resulted in around 4,600 sea turtles, mostly greens, found cold-stunned, with hundreds found dead or dying. 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. Additionally, 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.

3.2.3 Kemp's Ridley

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 2000b; 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 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 and 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 16), 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 nesting database 2013). In 2013 through 2014, there was a second significant decline, with only 16,385 and 11,279 nests recorded, respectively. 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.[20]

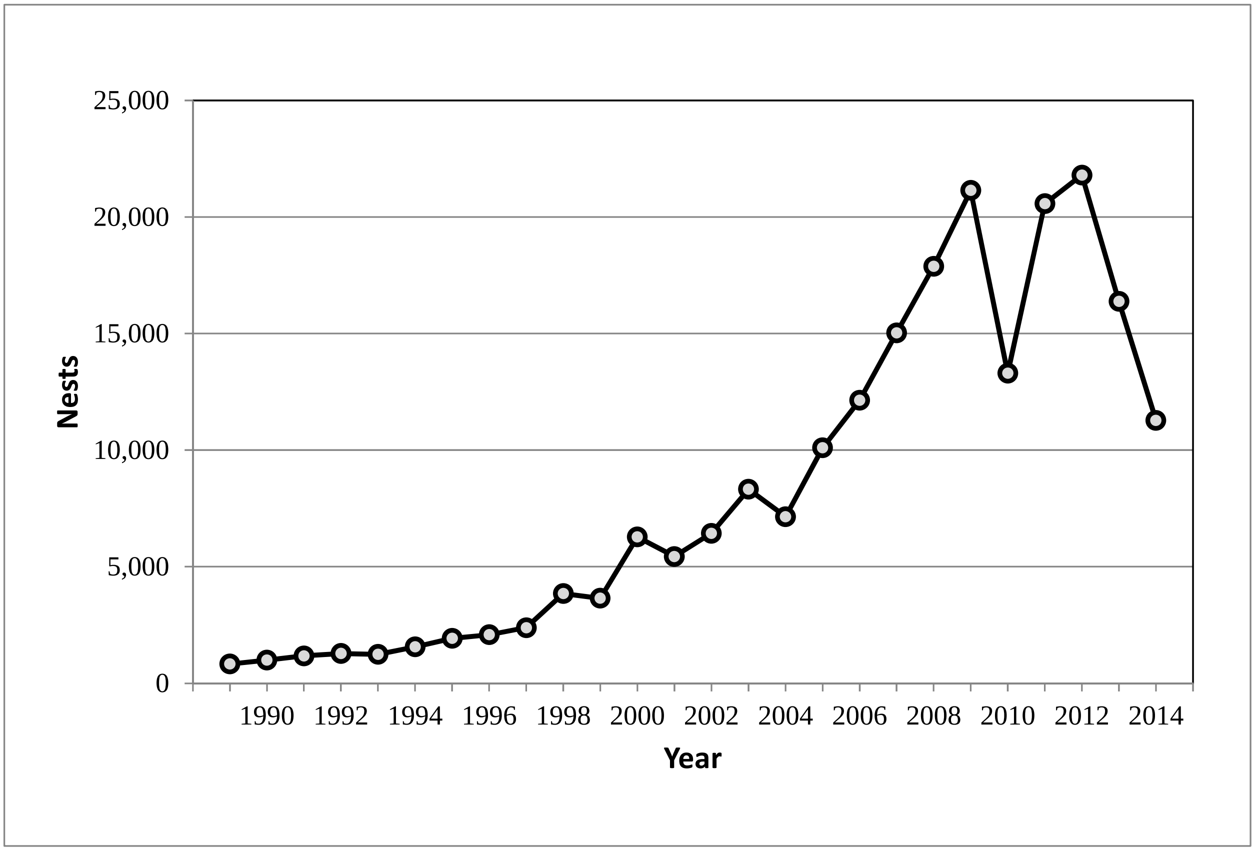


Figure 16. Kemp's ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2014)

Heppell et al. (2005) predicted in a population model that the population is expected to increase at least 12-16% per year and that the population could attain 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 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 2012, it is clear that the population is steadily increasing over the long term. The recent increases in Kemp's ridley sea turtle nesting seen in the last 2 decades is likely due to a combination of management measures including elimination of direct harvest, nest protection, the use of turtle excluder devices (TEDs), reduced trawling effort in Mexico and the United States, and possibly other changes in vital rates (TEWG 1998; 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. Additionally, the significant nesting declines observed in 2010 and 2013-2014 potentially indicate a serious

[20] National Park Service data, http://www.nps.gov/pais/naturescience/strp.htm, http://www.nps.gov/pais/naturescience/current-season.htm

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 3.2.1 with the heading *General Threats Faced by All Sea Turtle Species*; 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[21] 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 3 years, NMFS has documented via the Sea Turtle Stranding and Salvage Network (STSSN) data[22] 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 Deepwater Horizon 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) occurring from March through July, 390 (86%) of which were Kemp's ridley sea turtles. During 2012, a total of 428 sea turtles were reported from Louisiana, Mississippi, and Alabama waters, though the data is incomplete. Of these reported strandings, 301 (70%) 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 Deepwater Horizon 2010 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

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

[22] http://www.sefsc.noaa.gov/species/turtles/strandings.htm

interactions (B. Stacy, NMFS, pers. comm. to M. Barnette, NMFS, March 2012). Yet available information indicates fishery effort was extremely limited during the stranding events. The fact that in both 2010 and 2011 approximately 85% of all Louisiana, Mississippi, and Alabama stranded sea turtles were Kemp's ridleys is notable; however, this could simply be a function of the species' preference for shallow, inshore waters coupled with increased population abundance as reflected in recent Kemp's ridleys' 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 one of which 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), and 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.

3.2.4 Atlantic Sturgeon

Five separate DPSs of Atlantic sturgeon were listed under the ESA by NMFS effective April 6, 2012 (77 FR 5880 and 5914, February 6, 2012). The New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs were listed as endangered. The Gulf of Maine DPS was listed as threatened.

Species Descriptions and Distributions

Atlantic sturgeon are long-lived, late-maturing, estuarine-dependent, anadromous fish distributed along the eastern coast of North America (Waldman and Wirgin 1998). Historically, sightings have been reported from Hamilton Inlet, Labrador, south to the St. Johns River, Florida (Murawski et al. 1977; Smith and Clugston 1997). Atlantic sturgeon may live up to 60 years, reach lengths up to 14 ft, and weigh over 800 lb (ASSRT 2007; Collette and Klein-MacPhee 2002). They are distinguished by armor-like plates (called scutes) and a long protruding snout that has 4 barbels (slender, whisker-like feelers extending from the head used for touch and taste). Atlantic sturgeon spend the majority of their lives in nearshore marine waters, returning to their natal rivers to spawn (Wirgin et al. 2002). Young sturgeon may spend the first few years of life in their natal river estuary before moving out to sea (Wirgin et al. 2002). Sturgeon are omnivorous benthic (bottom) feeders and filter quantities of mud along with their food. Adult sturgeon diets include mollusks, gastropods, amphipods, isopods, and fish. Juvenile sturgeon feed on aquatic insects and other invertebrates (Smith 1985).

Historically, Atlantic sturgeon were present in approximately 38 rivers in the United States from the St. Croix River, Maine to the St. Johns River, Florida, of which 35 rivers have been confirmed to have had a historical spawning population. Atlantic sturgeon are currently present in approximately 32 of these rivers, and spawning occurs in at least 20 of them. The marine range of Atlantic sturgeon extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. Because adult Atlantic sturgeon from all DPSs mix extensively in marine waters, we expect fish from all DPSs to be found in the action area.

Life History Information

Atlantic sturgeon populations show clinal variation, with a general trend of faster growth and earlier age at maturity in more southern systems. Atlantic sturgeon mature between the ages of 5-19 years in South Carolina (Smith et al. 1982), between 11-21 years in the Hudson River (Young et al. 1988), and between 22-34 years in the St. Lawrence River (Scott and Crossman 1973). Most Atlantic sturgeon adults likely do not spawn every year. Multiple studies have shown that spawning intervals range from 1-5 years for males (Caron et al. 2002; Collins et al. 2000e; Smith 1985) and 2-5 years for females (Stevenson and Secor 1999; Van Eenennaam et al. 1996; Vladykov and Greely 1963). Fecundity of Atlantic sturgeon has been correlated with age and body size, with egg production ranging from 400,000 to 8,000,000 eggs per year (Dadswell 2006; Smith et al. 1982; Van Eenennaam and Doroshov 1998). The average age at which 50% of maximum lifetime egg production is achieved is estimated to be 29 years, approximately 3-10 times longer than for other bony fish species examined (Boreman 1997).

Spawning adult Atlantic sturgeon generally migrate upriver in spring/early summer, which occurs in February-March in southern systems, April-May in mid-Atlantic systems, and May-July in Canadian systems (Bain 1997; Caron et al. 2002; Murawski et al. 1977; Smith 1985; Smith and Clugston 1997). In some southern rivers, a fall spawning migration may also occur (Moser et al. 1998; Rogers and Weber 1995; Weber and Jennings 1996). In the fall, Hager et al. (2014) captured an Atlantic sturgeon identified as a spawned-out female due to her size and concave stomach and also noted capture of other fish showing signs of wear suggesting males had been engaging in spawning behavior. In Virginia's James River, Balazik et al. (2012) captured 1 fish identified as a female in the fall during the 3-year study with a concave condition of the abdomen consistent with female sturgeon that have spawned recently. In addition, postovulated eggs recovered from the urogenital opening were in an early degradation stage, suggesting the fish had spawned within days (Balazik et al. 2012). Further physiological support for fall spawning is provided by the 9 spermiating males captured along with the female and a grand total of 106 different spermiating males captured during August–October (Balazik et al. 2012). Randall and Sulak (2012) reported similar evidence for fall spawning of the closely related Gulf sturgeon, which included multiple captures of sturgeon in September–November that were ripe or exhibited just-spawned characteristics.

Atlantic sturgeon spawning occurs in fast-flowing water between the salt front and fall line of large rivers (Bain et al. 2000; Borodin 1925; Crance 1987; Leland 1968; Scott and Crossman 1973) over hard substrate, such as cobble, gravel, or boulders, to which the highly adhesive sturgeon eggs adhere (Gilbert 1989; Smith and Clugston 1997). Hatching occurs approximately 94-140 hours after egg deposition and larvae assume a demersal existence (Smith et al. 1980). The yolk sac larval stage is completed in about 8-12 days, during which time the larvae move downstream to rearing grounds (Kynard and Horgan 2002). During the first half of their migration downstream, movement is limited to night. During the day, larvae use benthic structure (e.g., gravel matrix) as refugia (Kynard and Horgan 2002). During the latter half of migration, when larvae are more fully developed, movement to rearing grounds occurs both day and night. Juvenile sturgeon continue to move further downstream into brackish waters, and eventually become residents in estuarine waters for months or years.

Juvenile and adult Atlantic sturgeon occupy upper estuarine habitat where they frequently congregate around the saltwater/freshwater interface. Estuarine habitats are important for juveniles, serving as nursery areas by providing abundant foraging opportunities, as well as thermal and salinity refuges, for facilitating rapid growth. Some juveniles will take up residency in non-natal rivers that lack active spawning sites (Bain 1997). Residency time of young Atlantic sturgeon in estuarine areas varies between 1-6 years (Schueller and Peterson 2010; Smith 1985), after which Atlantic sturgeon start out-migration to the marine environment. Out-migration of adults from the estuaries to the sea is cued by water temperature and velocity. Adult Atlantic sturgeon will reside in the marine habitat during the non-spawning season and forage extensively. Coastal migrations by adult Atlantic sturgeon are extensive and are known to occur over sand and gravel substrate (Greene et al. 2009). Atlantic sturgeon remain in the marine habitat until the waters begin to warm, at which time ripening adults migrate back to their natal rivers to spawn.

Upstream migration to the spawning grounds is cued primarily by water temperature and velocity. Therefore, fish in the southern portion of the range migrate earlier than those to the north do (Kieffer and Kynard 1993; Smith 1985). In Georgia and South Carolina, migration begins in February or March (Collins et al. 2000a). Males commence upstream migration to the spawning sites when waters reach around 6°C (Dovel and Berggren 1983; Smith 1985; Smith et al. 1982), with females following a few weeks later when water temperatures are closer to 12° or 13°C (Collins et al. 2000a; Dovel and Berggren 1983; Smith 1985). In some rivers, predominantly in the south, a fall spawning migration may also occur (Moser et al. 1998; Rogers and Weber 1995), with running ripe males found August through October and post-spawning females captured in late September and October (Collins et al. 2000e).

Status and Population Dynamics

At the time Atlantic sturgeon were listed, the best available abundance information for each of the 5 DPSs was the estimated number of adult Atlantic sturgeon spawning in each of the rivers on an annual basis. The estimated number of annually spawning adults in each of the river populations is insufficient to quantify the total population numbers for each DPS of Atlantic sturgeon due to the lack of other necessary accompanying life history data. A recently Atlantic sturgeon population estimate was derived from the Northeast Area Monitoring and Assessment Program (NEAMAP). NEAMAP trawl surveys were conducted from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina, in nearshore waters to depths of 60 ft from fall 2007 through spring 2012. The results of these surveys, assuming 50% gear efficiency (i.e., assumption that the gear will capture some, but not all, of the sturgeon in the water column along the tow path, and the survey area is only a portion of Atlantic sturgeon habitat), are presented in Table 6. It is important to note that the NEAMAP surveys were conducted primarily in the Northeast and may underestimate the actual population abundances of the Carolina and South Atlantic DPSs, which are likely more concentrated in the Southeast since they originated from and spawn there.

However, the total ocean population abundance estimates listed in Table 6 currently represent the best available population abundance estimates for the 5 U.S. Atlantic sturgeon DPSs.

Table 6. Summary of Calculated Population Estimates based upon the NEAMAP Survey Swept Area, Assuming 50% Efficiency (NMFS 2013)

DPS	Estimated Ocean Population Abundance	Estimated Ocean Population of Adults	Estimated Ocean Population of Subadults (of size vulnerable to capture in fisheries)
South Atlantic	14,911	3,728	11,183
Carolina	1,356	339	1,017
Chesapeake Bay	8,811	2,203	6,608
New York Bight	34,566	8,642	25,925
Gulf of Maine	7,455	1,864	5,591

South Atlantic DPS

The South Atlantic DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) of the Ashepoo, Combahee, and Edisto River (ACE) Basins southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. Rivers known to have current spawning populations within the range of the South Atlantic DPS include the Combahee, Edisto, Savannah, Ogeechee, Altamaha, and Satilla Rivers. We determined spawning was occurring if young-of-the-year (YOY) were observed, or mature adults were present, in freshwater portions of a system. However, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development.

Historically, both the Broad-Coosawatchie and St. Marys Rivers were documented to have spawning populations; there is also evidence that spawning may have occurred in the St. Johns River or one of its tributaries. The spawning population in the St. Marys River, as well as any historical spawning population in the St. Johns, are believed to be extirpated, and the status of the spawning population in the Broad-Coosawatchie is unknown. Both the St. Marys and St. Johns rivers are used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. The use of the Broad-Coosawatchie by sturgeon from other spawning populations is unknown at this time. The presence of historical and current spawning populations in the Ashepoo River has not been documented; however, this river may currently be used for nursery habitat by young Atlantic sturgeon originating from other spawning populations. This represents our current knowledge of the river systems utilized by the South Atlantic DPS for specific life functions, such as spawning, nursery habitat, and foraging. Still, fish from the South Atlantic DPS likely use other river systems than those listed here for their specific life functions.

Prior to the collapse of the fishery in the late 1800s, the sturgeon fishery was the third largest fishery in Georgia. Secor (2002) estimated from U.S. Fish Commission landing reports that approximately 11,000 spawning females were likely present in Georgia and 8,000 adult females were present in South Carolina prior to 1890. The Altamaha River population of the South Atlantic DPS, with an estimated 343 adults spawning annually, is believed to be the largest remaining population in the Southeast, yet is estimated to be only 6% of its historical population size. The abundances of the remaining river populations within the South Atlantic DPS, each estimated to have fewer than 300 annually spawning adults, are estimated to be less than 1% of what they were historically (ASSRT 2007). The NEAMAP model estimates a minimum ocean population of 14,911 South Atlantic DPS Atlantic sturgeon, of which 3,728 are adults.

Carolina DPS

The Carolina DPS includes all Atlantic sturgeon that are spawned in the watersheds (including all rivers and tributaries) from the Albemarle Sound southward along the southern Virginia, North Carolina, and South Carolina coastal areas to Charleston Harbor. Rivers known to have current spawning populations within the range of the Carolina DPS include the Roanoke, Tar-Pamlico, Cape Fear, Waccamaw, and Yadkin-Pee Dee Rivers. We determined spawning was occurring if YOY were observed, or mature adults were present, in freshwater portions of a system. In some rivers, though, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. There may also be spawning populations in the Neuse, Santee, and Cooper Rivers, though it is uncertain.

Historically, both the Sampit and Ashley Rivers in South Carolina were documented to have spawning populations at one time, although the spawning population in the Sampit River is believed to be extirpated and the current status of the spawning population in the Ashley River is unknown. Both rivers may be used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. This represents our current knowledge of the river systems utilized by the Carolina DPS for specific life functions, such as spawning, nursery habitat, and foraging. Still, fish from the Carolina DPS likely use other river systems than those listed here for their specific life functions.

Historical landings data indicate that between 7,000 and 10,500 adult female Atlantic sturgeon were present in North Carolina prior to 1890 (Armstrong and Hightower 2002; Secor 2002). Secor (2002) estimates that 8,000 adult females were present in South Carolina during that same time frame. The Atlantic sturgeon spawning population in at least 1 river system (the Sampit River) within the Carolina DPS has been extirpated, and the statuses of 4 additional spawning populations are uncertain. There are believed to be only 5 of 7-10 historical spawning populations remaining in the Carolina DPS. In some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. The abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, are estimated to be less than 3% of what they were historically (ASSRT 2007). The NEAMAP model estimates a minimum ocean population of 1,356 Carolina DPS Atlantic sturgeon, of which 339 are adults.

Chesapeake Bay DPS

The Chesapeake Bay DPS includes all anadromous Atlantic sturgeons that are spawned in the watersheds that drain into the Chesapeake Bay and into coastal waters from the Delaware-Maryland border on Fenwick Island to Cape Henry, Virginia. Within this range, Atlantic sturgeon historically spawned in the Susquehanna, Potomac, James, York, Rappahannock, and Nottoway Rivers (ASSRT 2007). Spawning still occurs in the James River, and the presence of juvenile and adult sturgeon in the York River suggests that spawning may occur there as well

(ASSRT 2007; Greene et al. 2009; Musick et al. 1994). However, conclusive evidence of current spawning is available for the James River, only. Atlantic sturgeon that are spawned elsewhere are known to use waters of the Chesapeake Bay for other life functions, such as foraging and as juvenile nursery habitat, before entering the marine system as subadults (ASSRT 2007; Grunwald et al. 2008; Vladykov and Greely 1963; Wirgin et al. 2007).

Historically, the Chesapeake Bay DPS likely supported more than 10,000 spawning adults (ASSRT 2007; KRRMP 1993; Secor 2002). Current estimates of the Chesapeake Bay DPS from the NEAMAP model (Table 6) indicate the current number of spawning adults is likely an order of magnitude lower than historical levels (ASSRT 2007; Kahnle et al. 2007). The NEAMAP model estimates a minimum ocean population of 8,811 Chesapeake Bay DPS Atlantic sturgeon, of which 2,319 are adults.

<u>New York Bight DPS</u>

The New York Bight DPS includes all anadromous Atlantic sturgeon that spawn in the watersheds that drain into coastal waters from Chatham, Massachusetts, to the Delaware-Maryland border on Fenwick Island. Within this range, Atlantic sturgeon historically spawned in the Connecticut, Delaware, Hudson, and Taunton Rivers (ASSRT 2007; Murawski et al. 1977; Secor 2002). Spawning still occurs in the Delaware and Hudson Rivers, but there is no recent evidence (within the last 15 years) of spawning in the Connecticut and Taunton Rivers (ASSRT 2007). Atlantic sturgeon that are spawned elsewhere continue to use habitats within the Connecticut and Taunton Rivers for other life functions (ASSRT 2007; Savoy 2007; Wirgin and King 2011).

Prior to the onset of expanded fisheries exploitation of sturgeon in the 1800s, a conservative historical estimate for the Hudson River Atlantic sturgeon population was 10,000 adult females (Secor 2002). Current population abundance is likely at least one order of magnitude smaller than historical levels (ASSRT 2007; Kahnle et al. 2007; Secor 2002). Based on data collected from 1985-1995, there are 870 spawning adults per year in the Hudson River (Kahnle et al. 2007). Kahnle (2007; 1998) also showed that the level of fishing mortality from the Hudson River Atlantic sturgeon fishery during the period of 1985-1995 exceeded the estimated sustainable level of fishing mortality for the riverine population, and may have led to reduced recruitment. All available data on abundance of juvenile Atlantic sturgeon in the Hudson River Estuary indicate a substantial drop in production of young since the mid-1970s (Kahnle et al. 1998). A decline appeared to occur in the mid- to late 1970s followed by a secondary drop in the late 1980s (ASMFC 2010; Kahnle et al. 1998; Sweka et al. 2007). Catch-per-unit-effort (CPUE) data suggest that recruitment has remained depressed relative to catches of juvenile Atlantic sturgeon in the estuary during the mid- to late 1980s (ASMFC 2010; Sweka et al. 2007). From 1985-2007, there were significant fluctuations in CPUE. The number of juveniles appears to have declined between the late 1980s and early 1990s. While the CPUE is generally higher in the 2000s as compared to the 1990s, significant annual fluctuations make it difficult to discern any trend. The CPUEs from 2000-2007 are generally higher than those from 1990-1999; however, they remain lower than the CPUEs observed in the late 1980s. There is currently not enough information regarding any life stage to establish a trend for the Hudson River population (ASMFC 2010; Sweka et al. 2007).

There is no abundance estimate for the Delaware River population of Atlantic sturgeon. Harvest records from the 1800s indicate that this was historically a large population, with an estimated 180,000 adult females prior to 1890 (Secor 2002; Secor and Waldman 1999). Fisher (2009) sampled the Delaware River in 2009 to target YOY Atlantic sturgeon. The effort captured 34 YOY. Brundage and O'Herron (2003) also collected 32 YOY Atlantic sturgeon from the Delaware River in a separate study. Fisher (2011) reports that genetics information collected from 33 of the 2009 year class YOY indicates that at least 3 females successfully contributed to the 2009 year class. The capture of YOY in 2009 shows that successful spawning is still occurring in the Delaware River, but the relatively low numbers suggest the existing riverine population is limited in size. Similar to the Hudson River, there is currently not enough information to determine a trend for the Delaware River population. The ASSRT (2007) suggested that there may be less than 300 spawning adults per year for the Delaware River portion of the New York Bight DPS. The NEAMAP model estimates a minimum ocean population of 34,566 Atlantic sturgeon, of which 8,642 are adults.

Gulf of Maine DPS

The Gulf of Maine DPS includes all anadromous Atlantic sturgeons that are spawned in the watersheds from the Maine/Canadian border and, extending southward, all watersheds draining into the Gulf of Maine as far south as Chatham, Massachusetts. Within this range, Atlantic sturgeon historically spawned in the Androscoggin, Kennebec, Merrimack, Penobscot, and Sheepscot Rivers (ASSRT 2007). Spawning still occurs in the Kennebec and Androscoggin Rivers, and may still occur in the Penobscot River. Atlantic sturgeon continue to be present in the Kennebec River; in addition, they are captured in directed research projects in the Penobscot River. They are also observed in the Saco, Presumpscot, and Charles rivers where they were unknown to occur before or had not been observed to occur for many years. These observations suggest that the abundance of the Gulf of Maine DPS of Atlantic sturgeon is large enough that recolonization to rivers historically suitable for spawning may be occurring.

Historically, the Gulf of Maine DPS likely supported more than 10,000 spawning adults (ASSRT 2007; KRRMP 1993; Secor 2002), suggesting the recent estimate of spawning adults within the DPS is 1-2 orders of magnitude smaller than historical levels (i.e., hundreds to low thousands) (ASSRT 2007; Kahnle et al. 2007). The CPUE of subadult Atlantic sturgeon in a multifilament gillnet survey conducted on the Kennebec River was considerably greater for the period of 1998-2000 (CPUE = 7.43) compared to the CPUE for the period 1977-1981 (CPUE = 0.30). The CPUE of adult Atlantic sturgeon showed a slight increase over the same time period (1977-1981 CPUE = 0.12 versus 1998-2000 CPUE = 0.21) (Squiers 2004). There is also new evidence of Atlantic sturgeon presence in rivers (e.g., the Saco River) where they have not been observed for many years. Still, there is not enough information to establish a trend for this DPS. The NEAMAP model estimates a minimum ocean population of 7,455 Atlantic sturgeon, of which 1,864 are adults.

Viability of Atlantic Sturgeon DPSs

The concept of a viable population able to adapt to changing environmental conditions is critical to Atlantic sturgeon, and the low population numbers of every river population in the 5 DPSs on the East Coast put them in danger of extinction throughout their range. None of the riverine spawning populations are large or stable enough to provide with any level of certainty for continued existence of any of the DPSs. Although the largest impact that caused the precipitous decline of the species has been prohibited (directed fishing), the Atlantic sturgeon population sizes within each DPS have remained relatively constant at greatly reduced levels for 100 years. The largest Atlantic sturgeon population in the United States, the Hudson River population within the New York Bight DPS, is estimated to have only 870 spawning adults each year. The Altamaha River population within the South Atlantic DPS is the largest Atlantic sturgeon population in the Southeast and only has an estimated 343 adults spawning annually. All other Atlantic sturgeon river populations in the U.S. are estimated to have less than 300 spawning adults annually.

Small numbers of individuals resulting from drastic reductions in populations, such as occurred with Atlantic sturgeon due to the commercial fishery, can remove the buffer against natural demographic and environmental variability provided by large populations (Berry 1971; Shaffer 1981; Soulé 1980). Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon, and they continue to face a variety of other threats that contribute to their risk of extinction. Their late age at maturity provides more opportunities for individual Atlantic sturgeon to be removed from the population before reproducing. While a long life span allows multiple opportunities to contribute to future generations, it also increases the time frame over which exposure to the multitude of threats facing Atlantic sturgeon can occur.

The viability of the Atlantic sturgeon DPSs depends on having multiple self-sustaining riverine spawning populations and maintaining suitable habitat to support the various life functions (spawning, feeding, growth) of Atlantic sturgeon populations. Because a DPS is a group of populations, the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. The loss of any population within a DPS will result in: (1) a long-term gap in the range of the DPS that is unlikely to be recolonized; (2) loss of reproducing individuals; (3) loss of genetic biodiversity; (4) potential loss of unique haplotypes; (5) potential loss of adaptive traits; (6) reduction in total number; and (7) potential for loss of population source of recruits. The loss of a population will negatively impact the persistence and viability of the DPS as a whole, as fewer than 2 individuals per generation spawn outside their natal rivers (King et al. 2001; Waldman et al. 2002; Wirgin et al. 2000). The persistence of individual populations, and in turn the DPS, depends on successful spawning and rearing within the freshwater habitat, the immigration into marine habitats to grow, and then the return of adults to natal rivers to spawn.

Threats

Atlantic sturgeon were once numerous along the East Coast until fisheries for their meat and caviar reduced the populations by over 90% in the late 1800s. Fishing for Atlantic sturgeon became illegal in state waters in 1998 and in remaining U.S. waters in 1999. Dams, dredging, poor water quality, and accidental catch (bycatch) by fishers continue to threaten Atlantic sturgeon. Though Atlantic sturgeon populations appear to be increasing in some rivers, other river populations along the East Coast continue to struggle and some have been eliminated entirely. The 5 DPSs of Atlantic sturgeon were listed as threatened or endangered under the ESA primarily as a result of a combination of habitat restriction and modification, overutilization (i.e., being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

Dams

Dams for hydropower generation, flood control, and navigation adversely affect Atlantic sturgeon by impeding access to spawning, developmental, and foraging habitat, modifying free-flowing rivers to reservoirs, physically damaging fish on upstream and downstream migrations, and altering water quality in the remaining downstream portions of spawning and nursery habitat (ASSRT 2007). Attempts to minimize the impacts of dams using measures such as fish passage have not proven beneficial to Atlantic sturgeon, as they do not regularly use existing fish passage devices, which are generally designed to pass pelagic fish (i.e., those living in the water column) rather than bottom-dwelling species, like sturgeon. Within the range occupied by the Carolina DPS, dams have restricted Atlantic sturgeon spawning and juvenile developmental habitat by blocking over 60% of the historical sturgeon habitat upstream of the dams in the Cape Fear and Santee-Cooper River systems. Water quality (velocity, temperature, and DO downstream of these dams, as well as on the Roanoke River, has been reduced, which modifies and restricts the extent of spawning and nursery habitat for the Carolina DPS.

Within the range of the New York Bight DPS, the Holyoke Dam on the Connecticut River blocks further upstream passage; however, the extent that Atlantic sturgeon historically would have used habitat upstream of Holyoke is unknown. Connectivity may be disrupted by the presence of dams on several smaller rivers in the New York Bight region. Connectivity is disrupted by the presence of dams on several rivers in the range of the Gulf of Maine DPS. Within the Gulf of Maine DPS, access to historical spawning habitat is most severely impacted in the Merrimack River (ASSRT 2007). Construction of the Essex Dam blocked the migration of Atlantic sturgeon to 58% of its historically available habitat (ASSRT 2007). The extent that Atlantic sturgeon are affected by operations of dams in the Gulf of Maine region is currently unknown, although Atlantic sturgeon larvae have been found downstream of the Brunswick Dam in the Androscoggin River. This suggests that Atlantic sturgeon spawning may be occurring in the vicinity of at least 1 hydroelectric project and may be affected by its operations.

Dredging

Riverine, nearshore, and offshore areas are often dredged to support commercial shipping and recreational boating, construction of infrastructure, and marine mining. Environmental impacts of dredging include the direct removal/burial of prey species; turbidity/siltation effects; contaminant resuspension; noise/disturbance; alterations to hydrodynamic regime and physical habitat; and actual loss of riparian habitat (Chytalo 1996; Winger et al. 2000). According to Smith and Clugston (1997), dredging and filling impact important habitat features of Atlantic sturgeon as they disturb benthic fauna, eliminate deep holes, and alter rock substrates.

In the South Atlantic DPS, maintenance dredging is currently modifying Atlantic sturgeon nursery habitat in the Savannah River. Modeling indicates that the proposed deepening of the navigation channel will result in reduced DO and upriver movement of the salt wedge, restricting spawning habitat. Dredging is also modifying nursery and foraging habitat in the St. Johns River. For the Carolina DPS, dredging in spawning and nursery grounds modifies the quality of the habitat and is further restricting the extent of available habitat in the Cape Fear and Cooper

Rivers, where Atlantic sturgeon habitat has already been modified and restricted by the presence of dams. Dredging for navigational purposes is suspected of having reduced available spawning habitat for the Chesapeake Bay DPS in the James River (ASSRT 2007; Bushnoe et al. 2005; Holton and Walsh 1995). Both the Hudson and Delaware rivers have navigation channels that are maintained by dredging. Dredging is also used to maintain channels in the nearshore marine environment. Many rivers in the range of the Gulf of Maine DPS also have navigation channels that are maintained by dredging. Dredging outside of federal channels and in-water construction occurs throughout the range of the New York Bight and Gulf of Maine DPSs.

Water Quality

Atlantic sturgeon rely on a variety of water quality parameters to successfully carry out their life functions. Low DO and the presence of contaminants modify the quality of Atlantic sturgeon habitat and in some cases, restrict the extent of suitable habitat for life functions. Secor (1995) noted a correlation between low abundances of sturgeon during this century and decreasing water quality caused by increased nutrient loading and increased spatial and temporal frequency of hypoxic (low oxygen) conditions. Of particular concern is the high occurrence of low DO coupled with high temperatures in the river systems throughout the range of the Carolina and South Atlantic DPSs in the Southeast. Sturgeon are more highly sensitive to low DO than other fish species (Niklitschek and Secor 2009a; Niklitschek and Secor 2009c) and low DO in combination with high temperature is particularly problematic for Atlantic sturgeon. Studies have shown that juvenile Atlantic sturgeon experience lethal and sublethal (metabolic, growth, feeding) effects as DO drops and temperatures rise (Niklitschek and Secor 2005; Niklitschek and Secor 2009a; Niklitschek and Secor 2009c; Secor and Gunderson 1998).

Reductions in water quality from terrestrial activities have modified habitat utilized by the South Atlantic DPS. Low DO is modifying sturgeon habitat in the Savannah due to dredging, and non-point source inputs are causing low DO in the Ogeechee River and in the St. Marys River, which completely eliminates juvenile nursery habitat in summer. Low DO has also been observed in the St. Johns River in the summer. In the Pamlico and Neuse systems occupied by the Carolina DPS, nutrient-loading and seasonal anoxia are occurring, associated in part with concentrated animal feeding operations (CAFOs). Heavy industrial development and CAFOs have degraded water quality in the Cape Fear River. Water quality in the Waccamaw and Yadkin-Pee Dee Rivers has been affected by industrialization and riverine sediment samples contain high levels of various toxins, including dioxins. Decreased water quality also threatens Atlantic sturgeon of the Chesapeake Bay DPS, especially since the Chesapeake Bay system is vulnerable to the effects of nutrient enrichment due to a relatively low tidal exchange and flushing rate, large surface-to-volume ratio, and strong stratification during the spring and summer months (ASMFC 1998; ASSRT 2007; Pyzik et al. 2004). These conditions contribute to reductions in DO levels throughout the bay. The availability of nursery habitat, in particular, may be limited given the recurrent hypoxia (low DO) conditions within the Bay (Niklitschek and Secor 2005; Niklitschek and Secor 2010). Both the Hudson and Delaware Rivers, as well as other rivers in the New York Bight region, were heavily polluted in the past from industrial and sewer discharges. In the past, many rivers in Maine, including the Androscoggin River, were heavily polluted from industrial discharges from pulp and paper mills. While water quality has improved and most discharges are limited through regulations, many pollutants persist in the benthic environment of the New York Bight and Gulf of Maine DPSs. It is particularly problematic if pollutants are present on spawning and nursery grounds, as developing eggs and larvae are particularly susceptible to exposure to contaminants.

Water Quantity

Water allocation issues are a growing threat in the Southeast and exacerbate existing water quality problems. Taking water from one basin and transferring it to another fundamentally and irreversibly alters natural water flows in both the originating and receiving basins, which can affect DO levels, temperature, and the ability of the basin of origin to assimilate pollutants (GWC 2006). Water quality within the river systems in the range of the South Atlantic and Carolina DPSs is negatively affected by large water withdrawals. Known water withdrawals of over 240 million gallons per day are permitted from the Savannah River for power generation and municipal uses. However, permits for users withdrawing less than 100,000 gallons per day are not required, so actual water withdrawals from the Savannah and other rivers within the range of the South Atlantic DPS are likely much higher. In the range of the Carolina DPS, 20 interbasin water transfers in existence prior to 1993, averaging 66.5 million gallons per day (mgd), were authorized at their maximum levels without being subjected to an evaluation for certification by the North Carolina Department of Environment and Natural Resources or other resource agencies. Since the 1993 legislation requiring certificates for transfers, almost 170 mgd of interbasin water withdrawals have been authorized, with an additional 60 mgd, pending certification. The removal of large amounts of water from these systems will alter flows, temperature, and DO. Water shortages and “water wars” are already occurring in the rivers occupied by the South Atlantic and Carolina DPSs and will likely be compounded in the future by population growth and potentially by climate change.

Climate Change

The Intergovernmental Panel on Climate Change (IPCC) projects with high confidence that higher water temperatures and changes in extremes, including floods and droughts, will affect water quality and exacerbate many forms of water pollution—from sediments, nutrients, dissolved organic carbon, pathogens, pesticides, and salt, as well as thermal pollution—with possible negative impacts on ecosystems (IPCC 2008). In addition, sea level rise is projected to extend areas of salinization of groundwater and estuaries, resulting in a decrease of freshwater availability for humans and ecosystems in coastal areas. Some of the most heavily populated areas are low-lying, and the threat of salt water entering into its aquifers with projected sea level rise is a concern (USGRG 2004). Existing water allocation issues would be exacerbated, leading to an increase in reliance on interbasin water transfers to meet municipal water needs, further stressing water quality.

Dams, dredging, and poor water quality have already modified and restricted the extent of suitable habitat for Atlantic sturgeon spawning and nursery habitat. Changes in water availability (depth and velocities) and water quality (temperature, salinity, DO, contaminants, etc.) in rivers and coastal waters inhabited by Atlantic sturgeon resulting from climate change will further modify and restrict the extent of suitable habitat for Atlantic sturgeon. Effects could be especially harmful since these populations have already been reduced to low numbers, potentially limiting their capacity for adaptation to changing environmental conditions (Belovsky 1987; Salwasser et al. 1984; Soulé 1987; Thomas 1990).

The effects of changes in water quality (temperature, salinity, DO, contaminants, etc.) in rivers and coastal waters inhabited by Atlantic sturgeon are expected to be more severe for those populations that occur at the southern extreme of the Atlantic sturgeon's range, and in areas that are already subject to poor water quality as a result of eutrophication. The South Atlantic and Carolina DPSs are within a region the IPCC predicts will experience overall climatic drying (IPCC 2008). Atlantic sturgeon from these DPSs are already susceptible to reduced water quality resulting from various factors: inputs of nutrients; contaminants from industrial activities and non-point sources; and interbasin transfers of water. In a simulation of the effects of water temperature on available Atlantic sturgeon habitat in Chesapeake Bay, Niklitschek and Secor (2005) found that a 1°C increase of water temperature in the bay would reduce available sturgeon habitat by 65%.

Vessel Strikes

Vessel strikes are a threat to the Chesapeake Bay and New York Bight DPSs. Eleven Atlantic sturgeon were reported to have been struck by vessels on the James River from 2005 through 2007. Several of these were mature individuals. From 2004-2008, 29 mortalities believed to be the result of vessel strikes were documented in the Delaware River; at least 13 of these fish were large adults. The time of year when these events occurred (predominantly May through July, with 2 in August), indicate the animals were likely adults migrating through the river to the spawning grounds. Because we do not know the percent of total vessel strikes that these observed mortalities represent, we are not able to quantify the number of individuals likely killed as a result of vessel strikes in the Chesapeake and New York Bight DPSs.

Bycatch Mortality

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations, from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to Atlantic sturgeon in all 5 DPSs. Atlantic sturgeon are more sensitive to bycatch mortality because they are a long-lived species, have an older age at maturity, have lower maximum reproductive rates, and a large percentage of egg production occurs later in life. Based on these life history traits, Boreman (1997) calculated that Atlantic sturgeon can only withstand the annual loss of up to 5% of their population to bycatch mortality without suffering population declines. Mortality rates of Atlantic sturgeon taken as bycatch in various types of fishing gear range between 0% and 51%, with the greatest mortality occurring in sturgeon caught by sink gillnets. Currently, there are estimates of the number of Atlantic sturgeon captured and killed in sink gillnet and otter trawl fisheries authorized by Fishery Management Plans (FMPs) in the Northeast Region (Miller and Shepherd 2011). Those estimates indicate from 2006-2010, on average there were 1,548 and 1,569 encounters per year in observed gillnet and trawl fisheries, respectively, with an average of 3,118 encounters combined annually. Mortality rates in gillnet gear were approximately 20%, while mortality rates in otter trawl gear are generally lower, at approximately 5%. Atlantic sturgeon are particularly vulnerable to being caught in sink gillnets; therefore, fisheries using this type of gear account for a high percentage of Atlantic sturgeon bycatch. Atlantic sturgeon are incidentally captured in state and federal fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (ASMFC 2007; Stein et al. 2004). Little data exists on bycatch in the Southeast and high levels of bycatch underreporting are suspected. However, fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may access multiple river systems, they are subject to being caught in multiple fisheries throughout their range. In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins and low DO). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

4 ENVIRONMENTAL BASELINE

This section describes the effects of past and ongoing human and natural factors contributing to the current status of the species, its habitat (including designated critical habitat), and ecosystem within the action area, without the additional effects of the proposed action. In the case of ongoing actions, this section includes the effects that may contribute to the projected future status of the species, its habitat, and ecosystem. The environmental baseline describes a species' and habitat's health based on information available at the time of this consultation.

By regulation (50 CFR 402.02), environmental baselines for Opinions include the past and present impacts of all state, federal, or private actions and other human activities in, or having effects in, the action area. We identify the anticipated impacts of all proposed federal projects in the specific action area of the consultation at issue that have already undergone formal or early Section 7 consultation (as defined in 50 CFR 402.11), as well as the impact of state or private actions, or the impacts of natural phenomena, which are concurrent with the consultation in process (50 CFR 402.02).

Focusing on the impacts of the activities in the action area specifically allows us to assess the prior experience and state (or condition) of the endangered and threatened individuals. This consideration is important because in some states or life history stages, or areas of their ranges, or listed individuals will commonly exhibit, or be more susceptible to, adverse responses to stressors than they will be in other states, stages, or areas within their distributions. These localized stress responses or stressed baseline conditions may increase the severity of the adverse effects expected from the proposed action.

4.1 Sea Turtles

4.1.1 Status and Distribution of Sea Turtles within the Action Area

Sea turtle species occurring in the project area that may be adversely affected by the proposed action are loggerhead, green, and Kemp's ridley. Sea turtles found in the immediate project area may travel widely throughout the Atlantic, Gulf of Mexico, and Caribbean Sea, and individuals found in the action area can potentially be affected by activities anywhere within this wide range. These impacts outside of the action area are discussed and incorporated as part of the overall status of the species as detailed in Section 3 above. The following environmental baseline includes past and ongoing human activities in the action area (Figure 7) that relate to the status of the species. All of these species are highly migratory. The same individuals found in the action area may migrate into offshore waters and thus be impacted by activities occurring there; therefore, the species' statuses in the action area are considered to be the same as their range-wide statuses and supported by the species accounts in Section 3 of this Opinion.

There are approximately 300 kilometers of ocean-facing sandy beaches in South Carolina that provide suitable nesting habitat for sea turtles, including the barrier island beaches to the north and south of the Port of Charleston entrance channel.

4.1.2 Factors Affecting Sea Turtles in the Action Area

4.1.2.1 Federal Actions

In recent years, NMFS has undertaken 5 ESA Section 7 consultations to address the effects of federal actions on sea turtles, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to develop ways of reducing the probability of adverse effects of the action on sea turtles. Similarly, NMFS has undertaken recovery actions under the ESA and is addressing the problem of take of sea turtles and sturgeon in the fishing industry and other activities such as USACE dredging operations. The summary below of sources of incidental take of sea turtles and sturgeon includes only those federal actions in the South Atlantic which have already concluded or are currently undergoing formal Section 7 consultation.

4.1.2.1.1 Dredging

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

NMFS has previously determined in dredging Opinions that while oceangoing hopper-type dredges may lethally entrain protected species, non-hopper type dredging methods (e.g., clamshell or bucket dredging, cutterhead dredging, pipeline dredging, sidecast dredging) are slower and unlikely to overtake or adversely affect them. Incidents of take by mechanical and other non-hopper dredges appears to be exceedingly rare with none observed occurring in the Charleston area.

4.1.2.1.2 ESA Permits

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

Sea turtles are the focus of research activities authorized by a Section 10 permit under the ESA. Authorized activities range from photographing, weighing, and tagging sea turtles incidentally taken in fisheries, blood sampling, tissue sampling (biopsy), and performing laparoscopy on intentionally captured turtles. The number of authorized takes varies widely depending on the research and species involved but may involve the taking of hundreds of turtles annually. Most takes authorized under these permits are expected to be nonlethal. Before any research permit is issued, the proposal must be reviewed under the permit regulations (i.e., must show a benefit to the species). In addition, since issuance of the permit is a federal activity, issuance of the permit by NMFS must also be reviewed for compliance with Section 7(a)(2) of the ESA to ensure that issuance of the permit does not result in jeopardy to the species. There are currently 7 Section 10(a)(1)(A) scientific research permits issued to study sea turtles in the action area.

4.1.2.2 State or Private Actions

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

The STSSN includes many records of vessel interaction (crush and/or propeller injury) with sea turtles. The STSSN has documented 3,054 South Carolina stranding records (all species and size classes) in their database from 1980 through 2013. The stranding records include all causes of mortality, such as disease, hopper dredge impacts, hypothermic stunning (i.e., cold-stunning), interactions with fisheries, interactions with pollution, and vessel strikes. However, due to the condition of stranded turtles in many cases (i.e., decomposition), it was impossible to definitively determine actual cause of mortality for 70% of the specimens. In addition, it was not possible to determine in many cases whether the vessel strike occurred before or after the turtle’s death. Additionally, it should be noted that many turtles killed by anthropogenic causes will not show up in the strandings database, as the mortality event may occur far offshore or the damage to the turtle is so significant the carcass sinks, preventing the turtle from washing ashore. This point is important to remember when considering apparent geographical trends in the data, which may be an artifact of other factors rather than increased mortality risk in one area versus another. For example, turtles injured/killed in one area may potentially be more well-represented in the strandings data due to bathymetric constraints that concentrate both turtles and vessel traffic relatively close to shore when compared to other counties with a broader continental shelf, where turtles may not wash up and be documented in the database. Additionally, stranding information does not indicate where a potential mortality event (e.g., vessel strike) occurred, as a turtle could have been injured/killed at one location and then drifted with currents (i.e., generally northward with the Gulf Stream on the East Coast) for a considerable distance before coming ashore.

Given the variables described above, though there are numerous strandings of turtles indicating vessel strike impacts each year, the exact extent of the vessel traffic impact on sea turtles is not quantifiable at this time.

4.1.2.2.1 Fisheries

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

4.1.2.3 Marine Pollution

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

4.1.2.4 Conservation and Recovery Actions Shaping the Environmental Baseline

NMFS has promulgated a series of regulations aimed at reducing potential for incidental mortality of sea turtles from commercial fisheries in the action area. These include sea turtle release gear requirements for Atlantic Highly Migratory Species (HMS) fisheries and TED requirements for Southeast shrimp trawl. In addition to regulations, outreach programs have been established and data on sea turtle interactions with recreational fisheries is collected through the Marine Recreational Fishing Statistical Survey (MRFSS). The summaries below discuss all of these measures in more detail.

4.1.2.4.1 Regulations Reducing Threats to Sea Turtles from Fisheries

Bycatch Reduction Measures in the Pelagic Longline Fishery

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

Revised Use of Turtle Excluder Devices in Trawl Fisheries

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

4.1.2.5 Other Sea Turtle Conservation Efforts

Sea Turtle Handling and Resuscitation Techniques

NMFS published a Final Rule (66 FR 67495, December 31, 2001) detailing handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the Final Rule. These measures help to prevent mortality of hard-shelled turtles caught in fishing or scientific research gear. In addition, NMFS published NOAA Technical Memorandum SEFSC-524, "Careful Release Protocols for Sea Turtle Release with Minimal Injury," in June 2004.

Outreach and Education, Sea Turtle Entanglements, and Rehabilitation

There is an extensive network of STSSN participants along the Atlantic and Gulf of Mexico coasts who not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded sea turtles.

Stranding and Salvage Activities by NMFS, USFWS, and the USCG

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

Other Actions

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

4.2 Atlantic Sturgeon

4.2.1 Status and Distribution of Atlantic Sturgeon within the Action Area

Atlantic sturgeon were likely present in many South Carolina rivers/estuary systems historically, but it is not known where spawning occurred. Secor (2002) estimated that 8,000 spawning females were likely present prior to 1890; since then, populations have declined dramatically (Collins and Smith 1997). During the last 2 decades, Atlantic sturgeon have been observed in most South Carolina coastal rivers, although it is not known if all rivers support a spawning population (Collins and Smith 1997). Atlantic sturgeon are expected to occur throughout the action area both in marine waters and in the rivers associated with the CHP45.

Four Atlantic sturgeon (49-89 cm TL) were captured in 1987 in the Cooper River (Collins and Smith 1997). More recently during winter 2003, 3 juveniles were captured from the Cooper River. Because these sturgeon were not reproducing adults, it is not known if these small fish were residents or migrants as flood waters from the Pee Dee or Waccamaw River could have transported fish to the Santee-Cooper system via Winyah Bay and the Intercoastal Waterway (McCord 2004). Recent research carried out by Post et al. (2014) observed 7 Atlantic sturgeon in the Cooper River during the 3-year project and no Atlantic sturgeon in the Wando River. These fish were more commonly detected in the saltwater tidal zone with the exception of 1 Atlantic sturgeon that made a presumed spawning run to Pinopolis Dam in the fall of 2013. No Atlantic sturgeon spawning was observed. Historically, dredging and relocation trawling activities have both had interactions with Atlantic sturgeon, with 3 adults being observed taken during 22 years of dredging projects and 8 being relocated during relocation trawling efforts during that same time period.

Subadult Atlantic sturgeon form winter aggregations in the shipping channel outside Charleston Harbor (ASSRT 2007). Ongoing work by Arendt et al. (2015) is detecting tagged Atlantic sturgeon in the Charleston shipping channel and surrounding water. Atlantic sturgeon detections were accrued across 70 different animals (plus 1 with a sensor tag), 7 that were detected both in the shipping channel and other coastal waters, 26 that were only detected in the shipping channel, and 38 that were only detected in other coastal waters.

Historically, Atlantic sturgeon were abundant enough in South Carolina to support a commercial fishery with an average catch of 78,864 kg between 1880-1901 (Secor). Current abundance estimates for Atlantic sturgeon are not available for the Cooper River, or the Action Area. While specific abundance estimates are not available, the shad gillnet fishery in the Cooper River reported a 10-year average (2000 to 2009) of ~85 Atlantic sturgeon caught annually. There is no evidence of Atlantic sturgeon spawning in the Cooper River in recent history.

4.2.2 Factors Affecting Atlantic Sturgeon in the Action Area

As stated in Section 2.2 (“Action Area”), the proposed project is located in the Charleston area and includes all areas to be widened and/or dredged from the North Charleston Terminal down the Cooper River and from the Wando Welch Terminal down the Wando River to the confluence with the Cooper River, out the entrance channel to a point approximately 17.3 miles offshore to the sea buoy and from the entrance channel to the hard bottom habitat creation (reef) areas, the SCDNR reef, and the ODMDS location offshore (shown in Figure 1). Additionally, the action area will include any areas upstream of the project that experience changes in salinity, or approximately 3 miles south of “The Tee” (Figure 7).

4.2.2.1 Federal Actions

In recent years, NMFS has undertaken 9 ESA Section 7 consultations in the waters in or near the Port of Charleston to address the effects of federal actions on listed sturgeon. Of the 9, only 1 of these consultations considered Atlantic sturgeon due to their recent (June 2014) ESA listing.

NMFS is in the process of designating critical habitat for Atlantic sturgeon. The proposed designation is scheduled to publish in November of 2015, with the Final Rule to publish 1 year later.

4.2.2.1.1 Dredging

Maintenance dredging of Federal navigation channels can adversely affect Atlantic sturgeon populations due to their benthic nature. The Cooper River flows into Charleston Harbor, which is one of the busiest ports on the Atlantic Coast and is dredged regularly up to the Naval Weapons Station at about RM 22. No seasonal restrictions are placed on dredging in the Cooper River; however, a restriction is placed on hopper dredging conducted offshore of Charleston Harbor in the shipping channel during the summer months. Hopper dredging is only carried out in the entrance channel in the area (USACE 2014).

Hopper Dredging

Hopper dredges can lethally harm sturgeon directly by entraining sturgeon in dredge drag arms and impeller pumps. Historically, hopper dredging in the entrance channel to the Port of Charleston has taken 1 Atlantic sturgeon (1991 through 2013 data from the Sea Turtle Data Warehouse: http://el.erdc.usace.army.mil/seaturtles/).

Non-Hopper-type Dredging

NMFS has previously determined in dredging Opinions that, while oceangoing hopper-type dredges may lethally entrain protected species, non-hopper type dredging methods (e.g., clamshell or bucket dredging, cutterhead dredging, pipeline dredging,) are slower and unlikely to overtake or adversely affect them. The project may affect Atlantic sturgeon by injury or death as a result of interactions with equipment or materials used during dredging; however, NMFS believes the chance of injury or death from interactions with clamshell and/or hydraulic dredging equipment is discountable as these species are highly mobile and are likely to avoid the areas during construction. Additionally, taking of sturgeon by mechanical and hydraulic cutterhead dredges appears to be exceedingly rare with none observed occurring in the Charleston area (1991 through 2013 data from the Sea Turtle Data Warehouse: http://el.erdc.usace.army.mil/seaturtles/).

Dredging Related Habitat impacts

Riverine, nearshore, and offshore areas are often dredged to support commercial shipping and recreational boating, construction of infrastructure, and marine mining. Dredging activities can pose significant impacts to aquatic ecosystems by removing, disturbing, disposing, and re-suspending bottom sediments, modifying substrate type, and impacting the community structure of benthic macrofauna. Environmental impacts of dredging include the following: (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 riparian habitat (Chytalo 1996; Winger et al. 2000). In addition to direct effects, dredging operations may also impact sturgeon by destroying benthic feeding areas, disrupting spawning migrations, altering local hydrology, and resuspending fine sediments in spawning habitat that covers required substrate. Because sturgeon are benthic omnivores, the modification of the benthos could affect the quality, quantity and availability of sturgeon prey species.

4.2.2.1.2 ESA Permits

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

Authorization of research and enhancement activities on Atlantic sturgeon is established through the issuance of an ESA Section 10(a)(1)(A) permit. There are currently 3 Section 10(a)(1)(A) scientific research permits issued to study sturgeon in the action area. The specific stressors to fish subject to NMFS-issued ESA permit conditions are capture in nets; handling and restraint during examinations; tagging using PIT, internal, and external tags; tissue sampling; anesthetizing; laparoscopy; blood sampling; and gonad biopsy.

4.2.2.2 State or Private Actions

A number of activities that may directly or indirectly affect Atlantic sturgeon include impacts from fisheries, wastewater systems, stormwater systems, and residential or commercial developments adjacent to waterways. The direct and indirect impacts from some of these activities are difficult to quantify. Where possible, conservation actions through the ESA Section 7 processes, ESA Section 10 permitting, ESA Section 6 cooperative agreements, and state permitting programs are being implemented to monitor or study impacts from these sources.

4.2.2.2.1 Fisheries

The ESA listing prohibits the direct harvest of Atlantic sturgeon. Still, sturgeon are taken incidentally in state fisheries that deploy nets. They are also likely targeted by poachers throughout their range (Collins et al. 1996; Dadswell 1979; Dovel et al. 1992). Impacts from poaching are unknown.

The incidental capture of sturgeons in the South Carolina and Georgia gillnet fishery for American shad (*Alosa sapidissima*) and the trawl fishery for penaeid shrimp (*Penaeus* spp.) was summarized by Collins et al. (Collins et al. 1996). Collins et al. (1996) reported the commercial shad fishery was active from approximately mid-January through mid-April along the south Atlantic coast; sturgeons captured in the shad gillnet fishery were primarily adults. Entanglement of sturgeon in gillnets can result in injury and mortality, reduced fecundity, and delayed or aborted spawning migrations (Collins et al. 2000a; Moser 2000; Moser and Ross 1993; Moser and Ross 1995; Weber 1996).

Mandatory reporting of sturgeon bycatch was initiated in 2000 by the Atlantic States Marine Fisheries Commission. According to their data, between 2000 and 2009 the average annual bycatch of Atlantic sturgeon reported by the commercial shad fishery was 84.7 Atlantic sturgeon. Poaching is likely another fishing threat and may be more prevalent where legal markets for sturgeon exist from imports, commercial harvest, or commercial culture; impacts from poaching to individual population segments are unknown.

4.2.2.3 Other Potential Sources of Impacts in the Environmental Baseline

Dams

Dams and their operations are the cause of major instream flow alteration in the Southeast (USFWS et al. 2001). Hill (1996) identified the following impacts of altered flow to anadromous fishes by dams: (1) altered DO concentrations and temperature; (2) artificial destratification; (3) water withdrawal; (4) changed sediment load and channel morphology; (5) accelerated eutrophication and change in nutrient cycling; and (6) contamination of water and sediment. Activities associated with dam maintenance, such as dredging and minor excavations along the shore, can release silt and other fine river sediments which can be deposited in nearby spawning habitat. Dams may reduce the viability of sturgeon populations by removing free-flowing river habitat. Seasonal deterioration of water quality can be severe enough to kill fish in deep storage reservoirs that receive high nutrient loadings from the surrounding watershed (Cochnauer 1986). Important secondary effects of altered flow and temperature regimes include decreases in water quality, particularly in the reservoir part of river segments, and changes in physical habitat suitability, particularly in the free-flowing part of river segments or areas downstream. The most commonly reported factor influencing year-class strength of sturgeon species is flow during the spawning and incubation period (Jager et al. 2002).

The Santee River Basin is geographically segmented by about 50 dams on the mainstem rivers (USFWS et al. 2001). These dams dictate distribution of diadromous fishes throughout the basin as they impede or impair upstream and/or downstream movement. The lowermost Pinopolis Dam blocks access to the basin and historical sturgeon spawning areas and blocks dam-locked sturgeon from accessing foraging areas at the freshwater/saltwater interface.

Between 1943 and 1985, most of the natural flow of the Santee River was diverted into Lake Moultrie and discharged into the Cooper River. This diversion resulted in severe silting in the Cooper River and Charleston Harbor during that period. To alleviate this problem, in 1985 the USACE constructed another canal to redivert water from Lake Moultrie back into the Santee River. The normal operation of Lake Moultrie releases a daily average of 4,500 cubic feet per second (cfs) into the Cooper River—enough to keep the salinity of the river low—and returns the remainder of its discharge—on average about 10,000 cfs—to the Santee River.

Prior to diversion, saline conditions extended ~18 miles up the Cooper River from the mouth of Charleston Harbor and a distinct salt wedge extended upstream ~ 9 miles (Mathews and Shealy 1978; Mathews and Shealy 1982). Following rediversion, saline waters extended approximately 31 miles up the Cooper River, with salinities primarily controlled by tidal stage rather than seasonal freshwater flow. Since rediversion, the lower fresh water discharge rate has eliminated much of the seasonal variability previously reported (Davis et al. 1990). Because of these reductions in flow and increases in salinity, the quality of habitat below the Pinopolis is less than ideal and does not support viable sturgeon spawning.

In a separate ESA Section 7 consultation[23], passage will be implemented for sturgeon at the Pinopolis Dam. Once that occurs, sturgeon will be able to move into more appropriate waters for spawning and will have access to the adjacent Santee River for foraging and rearing. The Santee River is likely to support foraging activity given its estuarine habitat. While the transition zone moving approximately one-half mile upstream is a measureable change, NMFS believes it will be insignificant for sturgeon living in the waters of the Cooper River and Charleston Harbor due of the availability of habitat upstream and habitat available in the adjacent Santee River once passage is implemented at Pinopolis.

4.2.2.3.1 Water Quality (riverine)

Water quality is influenced by water entering from Charleston Harbor on the rising tide which pushes salt water upriver as far as the Pinopolis Dam. The ongoing presence of the dams' water withdrawals exacerbate these issues. For example, the BP Amoco Cooper River chemicals plant near Charleston has the greatest surface-water use, withdrawing 2,619 million gallons from the Cooper River annually. The Harbor/Cooper River/Wando River portion of the system (consisting of the Tail Race Canal, West Branch Cooper River, East Branch Cooper River, Shipyard Creek, Town Creek, Back River, Goose Creek, Wando River and Charleston Harbor) is not considered to be impaired with respect to dissolved oxygen (with the exception of a Wando River monitoring site); however, available information indicates much of the system does not meet the applicable water quality standard for dissolved oxygen for significant periods of time and is considered water quality limited(SCDHEC 2013).

4.2.2.3.2 Conservation and Recovery Actions Shaping the Environmental Baseline

In 2007, NMFS published a status review report for Atlantic sturgeon. Atlantic Sturgeon was proposed for listing in October 2010 (75 FR 61904 and 61872), and placed on the Endangered Species List (77 FR 5880 and 5419) in February, 2012. The listing was effective April 6, 2012. NMFS has not yet drafted a Recovery Plan nor designated critical habitat for Atlantic Sturgeon. NMFS issued an ESA Section 10(a)(1)(A) permit (#17273) authorizing named federal and state agency personnel to collect, necropsy, sample and salvage dead shortnose and Atlantic sturgeon found beached, sunken, or floating, or those that are euthanized at U.S. facilities authorized to hold captive bred sturgeon. Opportunistic research on salvaged sturgeon may be useful for scientific or educational purposes.

5 EFFECTS OF THE ACTION ON THE SPECIES AND/OR DESIGNATED CRITICAL HABITAT

5.1 Effects of the Action on Sea Turtles and Atlantic Sturgeon

5.1.1 Dredging

The potential for adverse effects of dredging operations on sea turtles and Atlantic sturgeon has been previously assessed by NMFS (NMFS 1991; NMFS 1997b; NMFS 2007b) in the various versions of the regional Biological Opinions (RBO), the 2003 (revised in 2005 and 2007) Gulf of Mexico Regional Biological Opinion on Hopper Dredging (GRBO) completed in 2003 and

[23] Santee Cooper Hydroelectric Project - South Carolina - FERC Project No. 199-205.

revised in 2005 and 2007 (NMFS 2003a; NMFS 2005; NMFS 2007c) and the SARBO (NMFS 1997b). Additionally, the USACE has recently prepared a comprehensive analysis of data from Gulf and Atlantic hopper dredging projects to identify factors affecting sea turtle take rates (Dickerson et al. 2007). Furthermore, the USACE maintains the STDW with historical records of dredging projects and turtle and sturgeon interactions. These are the primary sources, discussed further below, for our analysis of dredging effects on sea turtles and sturgeon.

Non-Hopper Dredging
The project may affect sea turtles or Atlantic sturgeon by injury or death as a result of interactions with equipment or materials used during dredging; however, NMFS believes the chance of injury or death from interactions with clamshell and/or hydraulic dredging equipment is discountable as these species are highly mobile and are likely to avoid the areas during construction. Areas to be dredged using non-hopper dredges include the inner harbor including the turning basin enlargements at the Wando Welch, Navy base, and North Charleston Terminal. These turning basins will all be expanded to accommodate Post Panamax Generation II and Generation III container ships.

Channels maintained at frequent dredging intervals are not expected to be used extensively by sturgeon for feeding or other activities. Dredging activities can impact benthic assemblages either directly or indirectly and may vary in nature, intensity, and duration depending on the project, site location, and time interval between dredging operations. Though initial loss of benthic resources are likely, quick recovery between 6-months (McCauley et al. 1977; Van Dolah et al. 1984; Van Dolah et al. 1979) to two years (Bonsdorff 1980; Ray 1997) is expected; thus, the impacts to sturgeon foraging habitat are expected to be short-term and are therefore insignificant.

NMFS has received very few reported sea turtle takes associated with these dredging methods in the South Atlantic region: only 1 live sea turtle has been taken by a clamshell dredge over the past 20 years. The take occurred at Cape Canaveral, Florida, which routinely has very high local turtle abundance. Cold-stunned turtles have also been taken by cutterhead dredging, but this also rarely happens and has been generally limited to shallow, confined waters (e.g., Laguna Madre, Texas) or bays where turtles get trapped and stunned when the rapid passage of a cold front causes the temperature of the shallow water body to drop abruptly. Due to the infrequency of interactions with these equipment types and the project location and channel depths, NMFS believes that the likelihood of cold stunning is discountable, and also the possibility of a sea turtle being taken by a hydraulic cutterhead or a clamshell dredge is discountable.

Hopper Dredging
Hopper dredging was implicated in the mortality of South Atlantic endangered and threatened sea turtles as early as the late 1970s and in NMFS Opinions issued in 1979, 1980, and others leading to the RBO issued in 1991. This determination was repeated in the 1995 and 1997 SARBOs (NMFS 1995; NMFS 1997b). The measures established in consecutive RBOs (NMFS 1991; NMFS 2007a) to avoid and minimize sea turtle interactions during hopper dredging operations permitted by the USACE in the southeastern United States are included in this project, with the exception of certain project-specific modifications to dredge timing (i.e.,

"dredging window"), to use of the sea turtle deflector dragheads,[24] and conditions of/requirements for relocation trawling. These modifications are discussed in further detail below and in the following sections. Atlantic sturgeon were not included in the previous Opinions due to their recent ESA listing status. The USACE has documented interactions and takes of sturgeon were during both relocation trawling and dredging activities. In the South Atlantic region, only 9 incidental takes have occurred during hopper dredging operations, all of which were Atlantic sturgeon.

Calculation of Sea Turtle Entrainment Rates during Hopper Dredging
To calculate the expected rates of turtle and sturgeon entrainment in hopper dredging for this project, NMFS consulted the STDW to find the most applicable historic dredging information for the Port of Charleston.

From 2000 through 2013, maintenance dredging carried out by hopper dredge in the entrance channel of the Charleston Harbor generated approximately 23,608,818 yd^3 of material (Table 7). Twenty-two sea turtles (16 loggerhead, 4 Kemp's ridley, and 2 green) and 3 Atlantic sturgeon were documented/observed as taken in hopper dredges during these dredging events. To calculated the catch per unit effort (CPUE) we divided the number of animals taken by the quantity of material being dredged (23,6082818yd^3) resulting in CPUE of 0.0000006777 loggerhead (16/23,608,818=0.0000006777), 0.0000000847 green (2/23,608,818=0.0000000847), and 0.0000001694 Kemp's ridley sea turtles (4/23,608,818=0.0000001694), and 0.0000001271 Atlantic sturgeon (3/23,608,818=0.0000001271) per cubic yard dredged. To calculate the number of animals expected to be taken during this project, we then multiply the amount of material to be dredged by hopper during the CHP45 project (11,144,172yd^3) times the CPUE for each species. Our estimated, anticipated *detected* take estimates by species (i.e., those takes witnessed and documented by hopper dredge protected species observers) are 7.5525 loggerhead (11,144,172x0.0000006777=7.5525), 0.9441 green (11,144,172x0.0000000847=0.9441), and 1.8881 Kemp's ridley (11,144,172x 0.0000001694=1.8881)sea turtles, 1.4161 Atlantic sturgeon (11,144,172x 0.0000001271=1.4161). These values were then rounded up because it is not possible to take part of an animal resulting in a final estimated take of 8 loggerhead, 1 green, and 2 Kemp's ridley sea turtles, and 2 Atlantic sturgeon.

[24] The leading edge of the deflector is designed to have a plowing effect of at least 6 in depth when the draghead is being operated so as to deflect, rather than injure or entrain and kill, a sea turtle during dredging operations.

Table 7. Dredged Material Removed and Sea Turtle and Sturgeon Takes during Previous Dredging in the Port of Charleston Entrance Channel, 1991-2013 (STDW)[25]

Year	Quantity Dredged	Loggerhead Sea Turtle (NWA DPS)	Green Sea Turtle	Kemp's Ridley Sea Turtle	Atlantic Sturgeon
2012	1,304,000	0	1	0	1
2010	1,444,703	0	0	0	0
2008	519,537	0	0	0	0
2006	1,178,676	0	0	0	0
2004	1,449,234	3	0	0	0
2003	517,947	0	0	0	0
2001	4,535,537	0	0	0	0
2000	5,627,386	4	1	3	2
1999	1,562,690	1	0	0	0
1997	775,418	5	0	0	0
1995	1,583,677	0	0	0	0
1993	568,350	0	0	0	0
1992	2,165,238	0	0	0	0
1991	376,425	3	0	1	0
Total	3,608,818	16	2	4	3
	CPUE	**0.0000006777**	**0.0000000847**	**0.0000001694**	**0.0000001271**
CHP45	**11,144,172**	**7.5525**	**0.9441**	**1.8881**	**1.4161**
	Rounded up	**8**	**1**	**2**	**2**

Detected vs. Actual Takes

NMFS-approved observers monitor dredged material inflow and overflow screening baskets on many hopper dredging projects, and observers will be required to monitor the proposed action. Dredged material screening, however, is only partially effective, and observed takes likely provide only partial estimates of total sea turtle mortality. NMFS believes that some turtles killed by hopper dredges go undetected because body parts are forced through the sampling screens by water pressure and are buried in the dredged material, or animals are crushed or killed, but their bodies or body parts are not entrained by the suction and so the takes may go unnoticed. The only mortalities that are noticed and documented are those where body parts float, are large enough to be caught in the screens, and can be identified as sea turtle parts. Body parts that are forced through the 4-in (or greater) inflow screens by the suction-pump pressure and that do not float are very unlikely to be observed, since they will sink to the bottom of the hopper and not be detected by the overflow screening. Unobserved takes are not documented, thus, observed takes may under-represent actual lethal takes. It is not known how many turtles are killed but unobserved. Because of this, in the GRBO (NMFS 2003b), in making its jeopardy analysis, NMFS estimated that up to 1 out of 2 impacted turtles may go undetected (i.e., that observed take constituted only about 50% of total take). That estimate was based on region-wide (overall Gulf of Mexico) hopper dredging projects including navigation channel dredging and sand borrow area dredging for beach renourishment projects, year-round, including seasonal

[25] Only years in which hopper dredging occurred are listed in this table. Data was surveyed from 1991 through 2013.

windows when no observers are required, times when 100% coverage is required, and times when only 50% observer coverage is required (i.e., at sand borrow sites).

The proposed dredging of the CHP45 will include 100% observer coverage during hopper dredging operations for the duration of hopper dredging. A significantly greater number of turtles will be detected with 100% observer coverage, but a significant number of turtle parts will still pass through the screens undetected.

NMFS estimates that with 100% observer coverage, protected species observers aboard hopper dredges for the proposed project will detect approximately just 1 of every 2 turtles or sturgeon that are struck by the suction draghead and either crushed and pushed away or entrained during the CHP45. This results in an additional estimated 8 loggerhead, 1 green, and 2 Kemp's ridley sea turtles, and 2 Atlantic sturgeon taken, but not detected, for a total take of 16 loggerhead, 2 green, and 4 Kemp's ridley sea turtles, and 4 Atlantic sturgeon. We will use these totals, by species (estimates rounded up) for our jeopardy analyses because it is not possible to take a fraction of a sea turtle (Table 8).

Table 8. Estimated Sea Turtle Takes and Atlantic Sturgeon (Observed and Unobserved)
(assumed 50% detection rate by onboard protected species observers over the course of the project)

	Loggerhead Sea Turtle	Green Sea Turtle	Kemp's Ridley Sea Turtle	Atl Sturgeon
Observed	8	1	2	2
Unobserved	8	1	2	2
Total species takes for the CHP45	16	2	4	4

As with previous NMFS Opinions on hopper dredging, our subsequent (Section 7 of this Opinion) jeopardy analysis is necessarily based on our knowledge (in this case, our best estimate) of the total number of turtles and Atlantic sturgeon that will be lethally taken, which includes those that are killed but not detected. Our best estimate of turtles and sturgeon lethally taken will be the sum of the observed and unobserved takes, i.e., those observed and documented by onboard protected species observers, plus those unobserved, undocumented lethal takes (because the sea turtle and sturgeon parts were either not entrained, or were entrained but were not seen/counted by onboard protected species observers). For example, the 2003 GRBO on hopper dredging estimated that 80 loggerhead sea turtles would be killed annually by hopper dredges but that only 40 would be detected by onboard observers. Similarly, in this Opinion we have estimated that 16 loggerhead sea turtles, 2 green sea turtles, 4 Kemp's ridley sea turtles, and 4 Atlantic sturgeon will be killed by dredges, but shipboard protected species observers will only detect half of each of these takes by species.

Our ITS is based on observed takes, not only because observed mortality gives us an estimate of unobserved mortality, but because observed, documented take numbers serve as triggers for some of the reasonable and prudent measures, as well as for potential reinitiation of consultation should actual observed takes exceed the anticipated/authorized number of observed takes. Furthermore, our ITS level of anticipated/authorized lethal takes is based on the implementation of relocation trawling, since it is an integral and important part of the proposed action. Without the implementation of relocation trawling, mortalities resulting from hopper dredge activities are expected to be higher.

A very few turtles (over the years, a fraction of 1%) survive entrainment in hopper dredges, and those that do are usually smaller juveniles that are sucked through the pumps without being dismembered or badly injured. Often they will appear uninjured only to die days later of unknown internal injuries, while in rehabilitation. Experience has shown that the vast majority of hopper-dredge impacted turtles are immediately crushed or dismembered by the violent forces they are subjected to during entrainment. Therefore, we are conservatively predicting that all takes by hopper dredges will be lethal[26].

5.1.1.1 Assigning Interactions to the 5 Atlantic Sturgeon DPSs

Atlantic sturgeon mix extensively in the marine environment, and individuals from all 5 Atlantic sturgeon DPSs could interact with hopper dredging carried out in the entrance channel of the CHP45. In January 2012, the NMFS Northeast Region did a mixed stock analysis (MSA) of the composition of Atlantic sturgeon stocks along the East Coast using tag-recapture data and genetic samples that identify captured fish back to their DPS of origin. Atlantic sturgeon can be assigned to their DPS based on genetic analyses with 92-96% accuracy (ASSRT and NMFS 2007), though some fish used in the MSA could not be assigned to a DPS. Data from the Northeast Fisheries Observer Program (NEFOP) and the At Sea Monitoring (ASM) programs were used in the MSA to determine the percentage of fish from each of the DPSs at the selected locations along the coast.

Marine Mixing Zone 3, which extends from Cape Hatteras to the tip of Florida, corresponds to the South Atlantic portion of the species range where the action area is located. The MSA was updated by the NMFS Northeast Region in February 2013. Since no new data for Marine Mixing Zone 3 were available, NMFS determined that the original data from the NEFOP and ASM programs represent the best available information. According to the MSA, the composition of Atlantic sturgeon in Marine Mixing Zone 3 by DPS is:

- 0-9% Gulf of Maine DPS
- 4-26% New York Bight DPS
- 7-18% Chesapeake Bay DPS
- 10-29% Carolina DPS
- 46-79% South Atlantic DPS

To be conservative, we will assume that the maximum percentage presented for each DPS is representative of the composition of Atlantic sturgeon in the South Atlantic. The numbers of Atlantic sturgeon from of each DPS potentially taken in the hopper dredge were estimated by multiplying the same maximum percentages of each DPS expected to be present in the South

[26] In a recent opinion analyzing a similar action, we adjusted the take estimates to account for sea turtle population growth since the last year of data used in the analysis. We have not taken the same approach in this opinion because of the shorter term of this project. Hopper dredging in the other project was to occur over 6 years, not just two years like this project. As well, data used to calculate take in this opinion included through 2013, which is more recent than the data used in the other opinion. Additionally, inserting population growth data will not change the take values derived in this opinion.

Atlantic by the total number of estimated Atlantic sturgeon captures (4; Table 8) as shown in Table 9. Note that the percentages will add up to more than 100% and the sum of each category of interactions by DPS will be greater than the total number of interactions presented in the previous section due to the usage of the highest percentage calculated by the MSA for each DPS. The total number of estimated and authorized takes from all DPSs will be limited to the actual/total take estimate for Atlantic sturgeon, i.e., 4 animals total (2 observed and 2 unobserved). Using the maximum percentage of each DPS will result in estimating and potentially authorizing up to the specified number from each DPS, but still not in excess of the actual/total take estimate for all DPSs combined.

Table 9. Estimated Number of Atlantic Sturgeon From Each DPS Taken by the Hopper Dredge during the CHP45 by DPS

DPS	Maximum Species Composition	4 Atlantic Sturgeon	Roundup
Gulf of Maine DPS	9%	0.36	1
New York Bight DPS	26%	1.04	2
Chesapeake Bay DPS	18%	0.72	1
Carolina DPS	29%	1.16	2
South Atlantic DPS	79%	3.16	4

5.1.2 Post-Dredging Operations (Bed-leveling Activities)

Bed-leveling is often associated with hopper dredging (and other types of dredging) operations, and may be utilized in this project. Bed-leveling does not use suction but redistributes sediments, rather than removing them. Plows, I-beams, or other seabed-leveling mechanical devices are often used for cleanup operations, i.e., to lower high spots left in channel bottoms and dredged material deposition areas by hopper dredges or other type dredges. Leveling devices typically weigh about 30-50 tons, are fixed with cables to a derrick mounted on a barge pushed or pulled by a tugboat at about 1-2 knots. Some evidence indicates that bed leveling devices may be responsible for occasional sea turtle mortalities (NMFS 2003b). Sea turtles may be crushed as the leveling device passes over a turtle which fails to move or is not pushed out of the way by the sediment wedge “wave” generated by and pushed ahead of the device. Sea turtles in Georgia waters may have been crushed and killed in 2003 by bed-leveling which commenced after the hopper dredge finished its work associated with the Brunswick Harbor Entrance Channel dredging. The local sea turtle stranding network reported stranded crushed sea turtles in the area where the bed-leveler dredge was working, within days after the dredge was in the area. Brunswick Harbor is also one of the sites where sea turtles captured by relocation trawlers sometimes show evidence of brumating (over-wintering) in the muddy channel bottom, which could explain why, if sea turtles were in fact crushed by bed-leveler type dredges (the most likely explanation), they failed to react quickly enough to avoid the bed-leveler. Bed-leveler use at other dredging operations has not resulted in observed or documented sea turtle mortalities; therefore, the best available evidence points to occasional potential interactions to brumating sea turtles at Brunswick. All things considered, the use of bed-levelers is probably preferable (less likely to result in sea turtle interactions) to the use of hopper dredges for cleanup operations, since turtles foraging, resting, or brumating on irregular bottoms are probably more likely to be entrained by suction dragheads than crushed by bed-levelers, because: (1) sea turtle deflector dragheads are less effective on uneven bottoms; (2) hopper dredges move considerably faster than bed-leveler “dredges”; and (3) bed-levelers do not use suction. Sturgeon mortality has not been linked to any bed leveling activities.

Historically these types of activities have not been required in the project area; however they may occur from Myers Bend and the Wando River downstream to Segment 1 in the entrance channel. NMFS believes it is unlikely that turtles or sturgeon may be adversely affected by potential bed-leveling activities during “high-spot cleanup” during the proposed action. If, however, injurious or lethal bed-leveler interactions appear to have occurred, based on reports of stranded turtles or sturgeon, they shall be immediately reported to NMFS, and reinitiation of consultation will be required.

5.1.3 Water quality

The proposed channel deepening will increase the salinity concentrations in the action area. The EFDC model predicted salinity changes resulting from the project. Figure 11 depicts the overall changes in salinity that are predicted the result from the proposed action. The greatest changes in salinity are projected in the Wando River. However, based on available information, Atlantic Sturgeon rarely utilize the Wando River (B. Post, SCDNR, pers. comm. to K. Reece, NMFS, April 8, 2015). Based on information in the DEIS, all projected salinity increases in the Cooper River will be less than one ppt, with the average change estimated to be less than 0.40 ppt. Due to the very small magnitude of the anticipated changes in salinity throughout portions of the action area, and the salinity tolerance of the life stages of Atlantic sturgeon potentially present in the action area, we anticipate that any direct effects would be insignificant.

The proposed channel deepening may also have an effect on dissolved oxygen (DO). The current average DO level in the Cooper River is 5.77 mg/L. Overall, the current values in the river range from average low values of 4.7 mg/L to average high levels of 7.6 mg/L. None of the data for the current conditions indicates any DO levels in the Cooper River less than 4.4 mg/L. The EFDC model was used to forecast future effect of the proposed project combined with the effects of all anticipated discharges to predict all future changes in DO. The model results indicate very minor DO reductions throughout the action area (average reduction of 0.03mg/L). Additionally, this analysis indicates that the combined effect of the proposed project with on-going and future unrelated discharges would result in Cooper River DO reductions ranging from less than 0.02 mg/L to 0.1256 mg/L. Due to the very small magnitude of the anticipated changes in DO throughout portions of the action area which are used by Atlantic sturgeon, we anticipate that any direct effects would be insignificant.

5.1.4 Dredged Material Disposal

NMFS believes the proposed marine dredged material disposal activities of approximately 40 MCY over the life of the deepening project (Table 1) are not likely to adversely affect sea turtles or Atlantic sturgeon. Sea turtles and sturgeon may be attracted to ODMDS or reef mitigation sites, to forage on the bycatch that may be occasionally found in the dredged material being dumped. As such, these species could be potentially impacted by the sediments being discharged overhead. However, NMFS has never received a report of an injury to a sea turtle or sturgeon resulting from burial in, or impacts from, dredged material disposal, neither from inshore or offshore disposal sites, anywhere the USACE conducts dredged material disposal operations.

Sea turtles and sturgeon are highly mobile and apparently are able to avoid a descending sediment plume discharged at the surface by a hopper dredge opening its hopper doors, or pumping its sediment load over the side. Even if temporarily enveloped in a sediment plume, NMFS believes the possibility of injury, or burial of normal, healthy sea turtles or sturgeon by dredged material (i.e., sand and silt) disposal, is discountable.

NMFS believes that foraging habitat for sea turtles or sturgeon is not likely a limiting factor in the action area due to the expansive amount of similar habitat offshore near the ODMDS and the reef mitigation sites, and thus the loss of potential sand bottom foraging habitat adjacent to, or on the surface of, the disposal areas or in the entrance channel (compared to remaining foraging habitat) from burial by dredged material sediments will have insignificant effects on sea turtles and sturgeon.

Reef mitigation sites include an “L” shaped berm along the south and west perimeter of the ODMDS. This area represents approximately 73 acres of the ODMDS with dimensions roughly 15,000 ft x 16,000 ft x 600 ft wide x 10 ft high. The reef is designed to mitigate for hardbottom impacts resulting from the deepening and would be a two tiered berm created with limestone rock dredged from the entrance channel. Additionally, the USACE will construct 8 new 33-acre reef sites with 4 located along the north side of the channel and 4 located along the south side of the channel (Figure 2). The hard substrate and rugosity of the 8 mitigative reef sites will provide attachment substrate for epifauna and are designed to replace the existing hardbottom that will be dredged as well as provide physical features/vertical structure to provide habitat diversity. Physical features which are believed to be important include material used, shape and landscape, substrate, relationship to currents, and size. While vertical relief is usually highly desirable, the harbottoms being impacted by the entrance channel dredging are not high relief reefs to begin with. The new reef feature will consist of individual low relief mounds separated by existing bottom native sands/sediment. The reef to be constructed will not impair navigation clearances as water depths in the mitigation area are between 35 and 50 feet. Each of the 8 patch reefs will be approximately 33-acres for a total of 264 acres of patch reefs. Combined with the ODMDS “L” shaped berm, a total of approximately 337 acres mitigating for both 186 acres of temporary impacts to hard bottom habitat along the margins of the channel as well as 28.6 acres of hardbottom habitat removed within the entrance channel during deepening activities. Effects to sea turtles and Atlantic sturgeon include the risk of injury from in-water construction (e.g., reef material (consisting of softball and larger basketball size pieces) placement by crane or by being pushed over the side of the barges), but will be discountable due to the species’ ability to move away from the project sites if disturbed. As well, sea turtles and Atlantic sturgeon may be adversely affected by being temporarily unable to use the sites for foraging or shelter due to avoidance of construction activities and related noise. These effects will be insignificant because they are located in open water, construction will not restrict movement of species in the area, and there is ample, alternate similar habitat adjacent to the project sites.

The risk of injury to sea turtles from collisions with dredge-related vessels is also considered discountable, considering the species’ mobility and the slow speed of the hopper dredge vessels and associated barges and scows. The risk of injury to Atlantic sturgeon from collisions with dredge-related vessels is discountable, considering the species’ demersal nature.

5.1.5 Relocation Trawling

While the USACE has proposed relocation trawling activities to reduce the density of sea turtles in the path of hopper dredges, they have not stated when relocation trawling will be carried out or at what effort level. Because no effort level has been stated by the USACE, NMFS will require closed net relocation trawling in RPM #1 (Section 9.3), in specific situations (stated in T&C 12), carried out in specific says (T&C 13). In order to authorize take resulting from relocation trawling, NMFS must require this activity as a RPM and not as a conservation measure. Relocation trawling is required only when it can be done safely, as a means to reduce sea turtle and sturgeon mortalities, because it is a proven method of reducing sea turtle and sturgeon density in front of an advancing hopper dredge and very likely results in reduced sea turtle and sturgeon/hopper dredge interactions.

Nets are dragged on the bottom for 30 minutes or less before each retrieval and re-setting. Its effects are mostly nonlethal and non-injurious to trawl captured sea turtles and sturgeon. Over the course of more than twenty years that relocation trawling has been conducted by the USACE, very few sea turtle mortalities (approximately 7, of which 3 died under unusual circumstances during relocation trawling associated with the Deepwater Horizon oil spill event in the Gulf of Mexico) have occurred, while approximately 3,000 sea turtles have been safely relocated (D. Dickerson, ERDC, Pers. Comm to K. Reece, NMFS, March 27, 2015). There have been no observed sturgeon mortalities during relocation trawling. NMFS has previously estimated in dredging Opinions that the risk of a sea turtle being killed in a capture trawl net (closed net) is less than 0.4%, and NMFS has no new information to alter the basis of that conclusion. NMFS believes that the possibility that a sea turtle or sturgeon will be killed or injured during capture trawling (using modified shrimp trawl nets) is discountable, given the low historic injury/mortality rate.

Relocation trawling conducted at previous Charleston Harbor projects has been somewhat limited; therefore, basing estimates of potential take during relocation trawling for the proposed action is difficult. During previous capture trawling (1991, 1992, 1997, 2000, 2004, and 2006) associated with hopper dredging in the Port of Charleston, a total of 127 sea turtles and 3 Atlantic sturgeon were safely trawled-captured and released over 93 days of relocation trawling[27] (Table 10). Similar capture work carried out by Arendt et al. (2012) between 2004 and 2007 to evaluate loggerhead sea turtle catch rates and demographic distributions in the Charleston entrance channel. Schwenter et al. (Schwenter et al. 2013) documented similar information for kemp's ridley sea turtles. Results from Arendt et al. (2012) and Schwenter et al. (2014) are also included in Table 10 and were used to further refine the CPUE. Results from all data calculate a CPUE for each species by dividing the number of animals previously relocated by the number of trawling days, or 1.5427 loggerhead (263/164=1.5427), 0.0061 green(1/164=0.0061), and 0.0366 Kemp's ridley (6/164=0.0366) sea turtles and 0.0488 Atlantic sturgeons (8/164=0.0488) per relocation trawling day. Hopper dredging in the entrance channel is expected to take 466 days to complete. It is possible for relocation trawling to occur every day during hopper dredging so we calculated potential non-lethal take based on relocation trawling occurring every day during hopper dredging (466). After multiplying the number of potential relocation trawling days times the CPUE and rounding up because you cannot take a fraction of an animal, we calculate that up to 719 (466 days x 1.5427) loggerhead, 3 (466 days x .0061) green, and 18 (466

[27] Data from the STDW

days x .0366) Kemp's ridley sea turtles and 23 (466 days x .0488) Atlantic sturgeon will be relocated during the CHP45.

Table 10. Relocation Trawling Efforts in the Port of Charleston Entrance Channel

Data	Year	Days	Loggerhead Sea Turtle	Green Sea Turtle	Kemp's Sea Turtle	ATL Sturgeon
Arendt et al 2012	2007	2	7	0	0	0
	2007	2	7	0	0	0
	2006	12	43	0	0	0
	2005	12	36	0	0	5
	2005	12	11	0	0	0
	2004	9	49	0	0	0
	2004	12	55	0	2[28]	0
	2004	10	16	0	0	0
STDW	2006	1	0	0	0	1
	2004	3	7	0	0	2
	2000	33	2	0	3	0
	1997	26	2	0	0	0
	1992	4	2	1	0	0
	1991	26	16	0	1	0
	Total	164	253	1	6	8
	CPUE	per day	1.5427	0.0061	0.0366	0.0488
	Potential for all days of hopper	466	718.89	2.84	17.05	22.73
	Rounded up		719.00	3.00	18.00	23.00

5.1.5.1 Assigning Interactions to the 5 Atlantic Sturgeon DPSs

As discussed previously in Section 5.1.1.1, animals relocated during the CHP45 could include sturgeon from all 5 Atlantic sturgeon DPSs. The total numbers of Atlantic sturgeon from of each DPS potentially relocated were estimated by multiplying the same maximum percentages of each DPS expected to be present in the South Atlantic by the total number of estimated Atlantic sturgeon relocations (22.73, Table 10) as shown in Table 11. Note that the percentages will add up to more than 100% and the total of each category of interactions by DPS will be greater than the total number of interactions presented in the previous section due to the usage of the highest percentage calculated by the MSA for each DPS. The total number of estimated and authorized takes from all DPSs will be limited to the actual/total take estimate for Atlantic sturgeon, i.e., 23 animals total. Using the maximum percentage of each DPS will result in estimating and potentially authorizing up to the specified number from each DPS, but still not in excess of the actual/total take estimate for all DPSs combined.

[28] Schwenter, J. A., and coauthors. 2013. Catch Rates and Demographics for Kemp's Ridley (Lepidochelys kempii) Sea Turtles Captured in Near-shore Coastal Waters Between Winyah Bay, SC and St. Augustine, FL. Sea Turlte Biology and Conservation. National Oceanic and Atmospheric Administration, Baltimore, MD.

Table 11. Estimated Number of Atlantic Sturgeon From Each DPS Relocated during the CHP45 by DPS, Rounded Up.

DPS	Maximum Species Composition	22.73 observed Atlantic Sturgeon	Roundup
Gulf of Maine DPS	9%	2.0457	3
New York Bight DPS	26%	5.9098	6
Chesapeake Bay DPS	18%	4.0914	5
Carolina DPS	29%	6.5917	7
South Atlantic DPS	79%	17.9567	18

The effects of this harassment of the turtles or sturgeon during 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 et al. 1991). Since turtle or sturgeon recaptures are rare, and recaptures that do occur typically happen several days to weeks after initial capture, cumulative adverse effects of recapture are not expected. We believe that properly conducted and supervised relocation trawling (i.e., observing trawl speed and tow-time limits, and taking adequate precautions to release captured animals) and tagging is unlikely to result in adverse effects to sea turtles or sturgeon. Thus, we believe that the probability that a sea turtle or sturgeon will be injured or killed during capture or non-capture relocation trawling is discountable.

5.2 Project effects on the Cooper River.

The HSI models were informed by the outputs from the hydrodynamic modeling (EFDC) to predict environmental conditions after the project is constructed. This analysis assesses changes in habitat quantity and quality. The HSI model used pre- and post-project salinity, temperature, currents and dissolved oxygen inputs from the EFDC model. Pertinent results of the HSI modeling are summarized below.

5.2.1 Spawning Habitat Impacts

The sturgeon spawning life stage is most affected by salinity in the habitat models. In the portions of the action area where Atlantic sturgeon may occur (throughout the project area but not in the Wando River), the forecast salinity changes occur in areas located approximately 3 miles south of “The Tee” (which is the red line in Figure 7). The proposed action is anticipated to change three “cells” from “suitable” to “non-suitable.” The affected areas are well downriver of historical spawning areas which typically are located in fast-flowing water between the salt front and fall line of large rivers (Bain et al. 2000; Borodin 1925; Crance 1987; Leland 1968; Scott and Crossman 1973) well above the Pinopolis Dam. The following information discusses spawning in the area by both Atlantic and shortnose sturgeon in order to capture the complete sturgeon spawning history in the area. As noted in section in section 3.1.4, shortnose sturgeon are not expected to be adversely affected by this action.

Sturgeon spawning (shortnose only) has been documented in the tailrace area immediately below the Pinopolis Dam since 1997 (Cooke and Leach 1999), but Cooke and Leach (1999) considered this area to be a surrogate spawning site because access upstream is blocked. One Atlantic sturgeon made what was thought to be a spawning run to the Pinolpolis Dam in recent years but no evidence of actual spawning was identified (B. Post, SCDNR, pers. comm. to K. Reece, NMFS, April 8, 2015). Kynard et al. (1999) as well considered this area atypical of preferred sturgeon spawning habitat, supporting the hypothesis that a migration blockage imposed spawning at a site that was not historically used. Fertilized shortnose sturgeon eggs collected in the Pinopolis Dam tailrace verified spawning despite non-traditional (i.e., barren hard bottom with scattered pockets of clam shell and marl pieces) spawning habitat (Cooke and Leach 2004; Duncan et al. 2004). Recent success of shortnose sturgeon spawning in this area is unknown (B. Post, SCDNR, pers. comm. to K. Reece, NMFS, 2012) but is thought to be unsuccessful due to existing water quality issues (salinity). Previous (1996-1998) population estimate (mark-recapture) of shortnose sturgeon in the Cooper River focused only on adults in the Pinopolis Dam tailrace (Cooke et al. 2004). Ages determined from the pectoral ray of 35 fish sub-sampled from the Pinopolis tailrace averaged 11 years (SD = 3.2), with no fish being less than 5 years old (Cooke et al. 2004). While a single Atlantic sturgeon made what appeared to be a spawning run in recent years (Post et al. 2014), there has been no evidence of any Atlantic sturgeon spawning in the Cooper River. The total area adversely affected by the projected salinity changes in this area is about 2.7% of the approximately 2,154 acres of currently available habitat. Because the habitat impacts of the project occurs in an area not considered spawning habitat, this change is unlikely to impact the spawning of this species and is considered insignificant.

5.2.2 Juvenile Life Stage Habitat Impacts

Juvenile sturgeon have been found to consume primarily benthic infauna while in the estuary (Huff 1975; Mason and Clugston 1993). Thus, any alterations within the estuary that changes either sediment grain size/sorting or chemistry may impact juvenile food resources (Kenny and Rees 1994; Seiderer and Newell 1999). Atlantic sturgeon are considered mature in South Carolina rivers at 5-19 years of age (Smith et al. 1982). Research carried out by Cooke et al. (2005) has shown sturgeon in Pinopolis tailrace averaged 11 years (SD = 3.2), with no fish being less than 5 years old. Juvenile sturgeon move downstream and inhabit brackish waters for a few months; and then move into coastal waters. Dredging modifies the quality of the habitat and further restricts the extent of available habitat in the Cooper River, where sturgeon habitat has already been modified and restricted by the presence of dams. Modeling described in the DEIS (USACE 2014) in several dozen model-grid cells predict substantial decreases in habitat suitability for juvenile Atlantic sturgeon following the CHP45 project (Figure 17) with large areas in the Wando River anticipated to decrease in juvenile habitat quality; however, juvenile Atlantic sturgeon are not known to use the Wando River. Other areas of decreased quality are scattered throughout the project area. Because there is no successful sturgeon spawning in the project area, any juvenile Atlantic sturgeon in the project area are likely migrants from other nearby systems. As migrants, these fish are already acclimated to increased salinity levels. As well, sturgeon are opportunistic feeders and will likely consume whatever types of bottom-dwelling organisms are present and area able to utilize areas with increased salinity with variable prey types and can also move to other more suitable areas. For these reasons, NMFS considers habitat changes in the action area to be insignificant to Atlantic sturgeon.

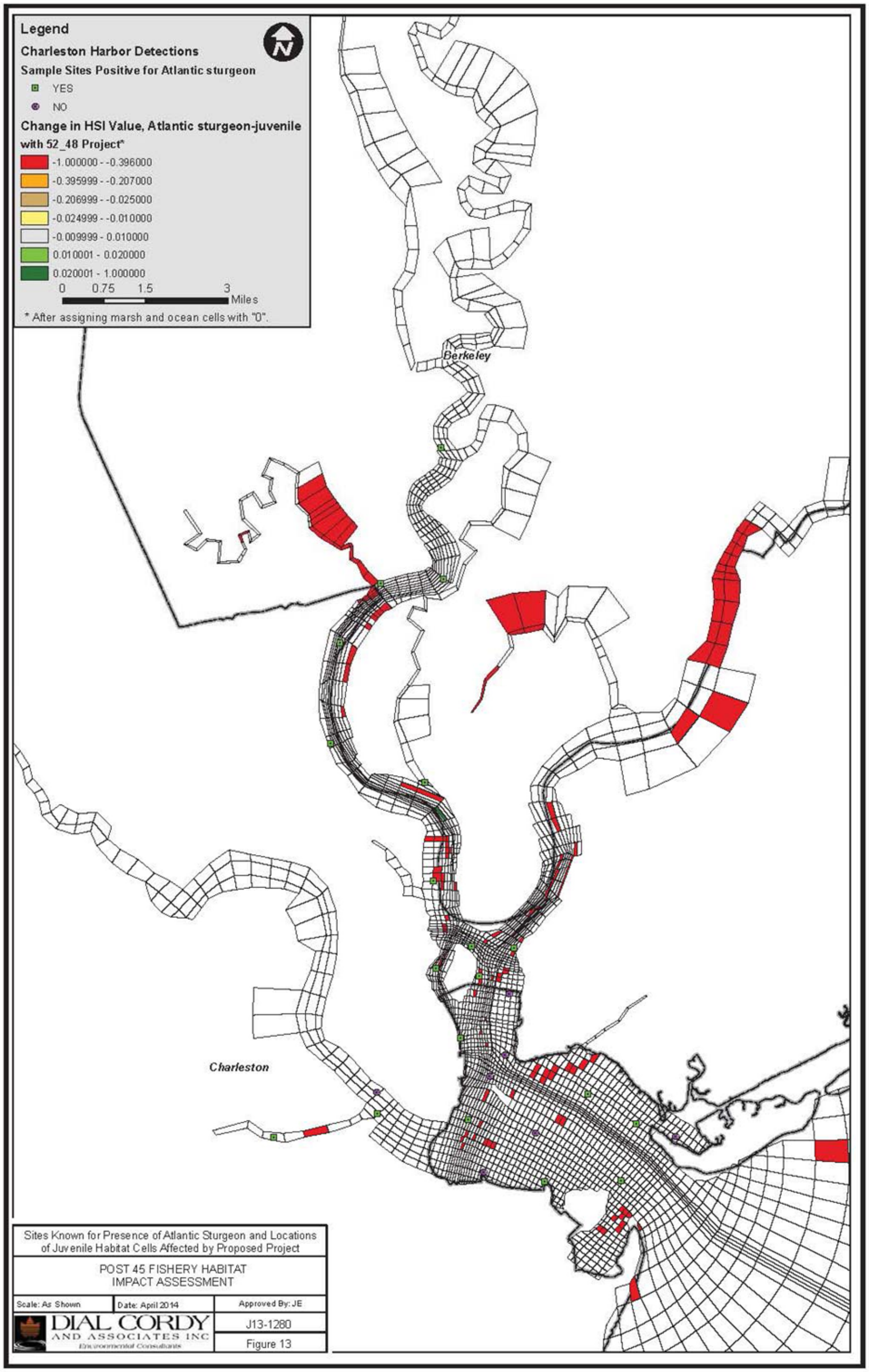

Figure 17. Results of HSI monitoring for juvenile life stage habitats (USACE 2014).

5.2.3 Adult Life Stage Habitat Impacts

The sturgeon adult life stage is most impacted by salinity and temperature. Modeling discussed in the DEIS determined the proposed action would not alter water temperature in a meaningful way to the species (USACE 2014). Salinity appears to be the ultimate driver for the projected impacts to habitats used by adult Atlantic sturgeon. With only a few exceptions at the mouth of the Ashley River, the north shore of James Island, and near Patriots Point heading east past Shem Creek, salinity-triggered habitat changes occur in the navigation channel or along the margins; these changes would result in a 4% reduction of available suitable habitat. (USACE 2014). This is because depths of these areas would increase and would result in a subsequent increase in salinity. These impacts are very small and essentially only take areas that had a salinity of just under the 28.6 ppt threshold to just over 28.6 ppt. SCDNR has documented the occurrence of Atlantic sturgeon within the harbor, and it is unlikely that the small changes to temperature that occur in and along the navigation channel will impact the adult life stage. The modeled results indicate the majority of changes will be within the channel where it is unlikely that sturgeon spend much time foraging. It is unlikely that the adult life stage will be impacted by a change of less than 4% modeled suitable habitat (USACE 2014) within the project area.

6 CUMULATIVE EFFECTS

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

Within the action area, major future changes are not anticipated in ongoing human activities described in the environmental baseline. The present human uses of the action area, such as commercial shipping, boating, and fishing, are expected to continue at the present levels of intensity in the near future as are their associated risks of injury or mortality to sea turtles and shortnose sturgeon posed by incidental capture by fishers, vessel collisions, marine debris, chemical discharges, and man-made noises.

6.1 Sea Turtles

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

NMFS presumes that any additional increases in recreational vessel activity in inshore and offshore waters of the Atlantic Ocean will likely increase the risk of turtles taken by injury or mortality in vessel collisions. Recreational hook-and-line fisheries have been known to lethally take sea turtles. Future cooperation between NMFS and the states on these issues should help decrease take of sea turtles caused by recreational activities. NMFS will continue to work with states to develop ESA Section 6 agreements and Section 10 permits to enhance programs to quantify and mitigate these takes.

6.2 Atlantic Sturgeon

Human activities that affect riverine water quality and quantity such as non-point and point-source discharges are also expected to continue at current rates. Future cooperation between NMFS and the GADNR and SCDNR should help decrease take of sturgeon caused by recreational activities. NMFS will continue to work with states to develop ESA Section 6 agreements and with researchers in Section 10 permits to enhance programs to quantify and mitigate these takes.

Climatically, sea level is expected to continue to rise, as are water temperatures, and levels of precipitation are likely to fluctuate more drastically. Nutrient loading, pollution inputs, lower dissolved oxygen are all expected to be exacerbated. Drought and inter- and intra-state water allocation and their associated impacts will continue and may intensify (IPCC 2008). As well, rise in sea level will likely drive the salt wedge farther upriver, further constricting sturgeon habitat; however, the effect of rising sea level is integrated into the predicted salinity effects of the proposed action (USACE 2014) and is therefore incorporated into the analysis of potential effects due to changes in salinity.

7 JEOPARDY ANALYSIS

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

It is the responsibility of the action 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 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 an 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 green, Kemp's ridley, and loggerhead (NWA DPS) sea turtles, and Atlantic sturgeon, to the effects of the action.

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

The nonlethal take of approximately 3 green sea turtles by capture relocation trawling will have no more than temporary, non-injurious effects on them. The lethal take of up to 2 green sea turtles by hopper dredging would reduce the number of green sea turtles as compared to the number that would have been present in the absence of the action assuming all other variables remained the same. The lethal take could also result in the loss of reproductive value as compared to the reproductive value in the absence of the proposed action, if the individual is female, eliminating her contribution to future generations. Greens nest frequently (at approximately 2-week intervals) during a nesting season and nest about every 2-4 years. During each nesting, they can produce an average of 110-115 eggs in each nest. The loss of an adult female could preclude the production of thousands of eggs and hatchlings, of which a small percentage is expected to survive to sexual maturity. Changes in distribution are not expected from lethal takes by hopper dredging during this action. Because the action area is small and sea turtles generally have large ranges in which they disperse, no reduction in the distribution of green sea turtles is expected from the take of 2 individuals.

The 5-year status review for green sea turtles states that of the 7 green sea turtle nesting concentrations in the Atlantic basin for which abundance trend information is available, all were determined to be either stable or increasing (NMFS and USFWS 2007a). That review also states that the annual nesting female population in the Atlantic basin ranges from 29,243-50,539 individuals. Additionally, the pattern of green sea turtle nesting shows biennial peaks in abundance, with a generally positive trend during the 20 years of regular monitoring since establishment of index beaches in Florida in 1989. An average of 5,099 green turtle nests were laid annually in Florida between 2001 and 2006 with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a).

Although the anticipated mortality of 2 green sea turtles expected from the proposed action would result in an instantaneous reduction in absolute population numbers, it is not likely these small reductions would appreciably reduce the likelihood of survival of the species. If the hatchling survival rate to maturity is greater than the mortality rate of the population, the loss of breeding individuals would be replaced through recruitment of new breeding individuals from successful reproduction of non-taken sea turtles. Capture of sea turtles by relocation trawlers will not affect the adult female nesting population or number of nests per nesting season. Considering that the species' nesting trends are either stable or increasing, we believe the loss of up to 2 green sea turtles associated with the proposed action is not expected to cause an appreciable reduction in the likelihood of survival of this species of sea turtle in the wild.

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

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

Green sea turtle nesting in Florida between 2001-2006 was documented as follows: 2001 – 581 nests; 2002 – 9,201 nests; 2003 – 2,622 nests; 2004 – 3,577 nests; 2005 – 9,644 nests; 2006 – 4,970 nests. The average is 5,039 nests annually over those 6 years (2001-2006) (NMFS and USFWS 2007a). Subsequent nesting has shown even higher average numbers (i.e., 2007 – 9,455 nests; 2008 – 6,385 nests; 2009 – 3, 000 nests; 2010 – 8,426 nests; 2011 – 10,701 nests), thus, this recovery criteria continues to be met.

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

Several actions are being taken to address this objective; however, there are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds. Given the clear increases in nesting, however, it is likely that numbers on foraging grounds have increased by at least the same amount. This Opinion's effects analysis assumes that in-water abundance has increased at the same rate as Tortuguero nesting.

The recovery plan includes 3 different recovery actions directly related to the proposed action of this Opinion: (1) Implement and enforce TED regulations (Priority 1), (2) promulgate regulations to reduce fishery related mortality (Priority 2), and (3) provide technology transfer for installation and use of TEDs (Priority). The proposed action does all of these things, thus supports continued implementation of the recovery plan.

The potential injury or mortality of 2 green sea turtles attributed to the proposed action are not likely to reduce population numbers over time due to current population sizes and expected recruitment. Despite the higher level of lethal interactions that occurred in the past, we have still seen positive trends in the status of this species. Capture of sea turtles by relocation trawlers will not affect the adult female nesting population or number of nests per nesting season.

In conclusion, we conclude the proposed action is not likely to impede the recovery objectives above and will not result in an appreciable reduction in the likelihood of green sea turtles' recovery in the wild.

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

As demonstrated by nesting increases at the main nesting sites in Mexico, adult Kemp's ridley numbers have increased over the last decade. Recent calculations of nesting females determined from nest counts show that the population trend is increasing towards that recovery goal, with an estimate of 4,047 nesters in 2006 and 5,500 in 2007 (Gladys Porter Zoo 2007; NMFS and USFWS 2007q). Recent nesting data indicated a population of an estimated 8,460 females in 2009 and 5,320 females in 2010 (J. Peña, Gladys Porter Zoo, pers. comm. to S. Heberling, NMFS, March 21, 2011). NMFS et al. (2011) produced an updated model that predicted the population to increase 19% per year and 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 2012, it is clear that the population is steadily increasing over the long term. Based on this information, the anticipated lethal take of up to 4 Kemp's ridley sea turtles would not be expected to have a detectable effect on the Kemp's ridley sea turtle reproduction or population numbers. Changes in distribution are not expected from lethal takes by hopper dredging during this action. Because the action area is small and sea turtles generally have large ranges in which they disperse, no reduction in the distribution of Kemp's ridley sea turtles is expected from the take of up to 4 individuals.

The nonlethal take of approximately 18 Kemp's ridley sea turtles by capture relocation trawling will have no more than temporary, non-injurious effects on them. Changes in distribution, even short-term, are not expected from nonlethal takes (interactions/releases from relocation trawling, vessel strikes, etc.) during the project. Interactions with vessels and/or relocation trawlers may elicit startle or avoidance responses and the effects of the proposed action may result in temporary changes in behavior of sea turtles (minutes to hours) over small areas, but are not expected to change the distribution of any sea turtles in the action area.

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

The following analysis considers the effects of the take on the likelihood of recovery in the wild. We consider the recovery objectives in the recovery plans prepared for each species that relate to population numbers or reproduction that may be affected by the predicted reductions in the numbers or reproduction of sea turtles resulting from the proposed action.

The recovery plan for Kemp's ridley sea turtles (NMFS and USFWS 1992), herein incorporated by reference, lists the following relevant recovery objective:

- Attain a population of at least 10,000 females nesting in a season.

The potential injury or mortality of 4 Kemp's ridleys will result in a reduction in overall population numbers. We already have determined this take is not likely to reduce population numbers over time due to current population sizes and expected recruitment. Capture of sea turtles by relocation trawlers will not affect the adult female nesting population or number of nests per nesting season because Kemp's ridley sea turtles are not known to nest regularly in or near the project area and relocated turtles are not prevented from nesting. Thus, the proposed action will not interfere with achieving the recovery objective and will not result in an appreciable reduction in the likelihood of Kemp's ridley sea turtles' recovery in the wild.

7.3 Effects of the Action on Loggerhead Sea Turtles' (NWA DPS) Likelihood of Survival and Recovery in the Wild

The nonlethal take of approximately 719 loggerhead sea turtles by capture relocation trawling will have no more than temporary, non-injurious effects on them. The lethal take of 16 loggerhead sea turtles by hopper dredges would result in an instantaneous, but temporary reduction in total population numbers. Thus, the proposed action will result in a reduction of sea turtle numbers. Sea turtle mortality resulting from hopper dredges could result in the loss of reproductive value of an adult turtle. For example, an adult female loggerhead sea turtle can lay 3 or 4 clutches of eggs every 2-4 years, with 100-130 eggs per clutch. The annual loss of 1 adult female sea turtle, on average, could preclude the production of thousands of eggs and hatchlings, of which a small percentage is expected to survive to sexual maturity. Thus, the death of an adult female eliminates an individual's contribution to future generations, and the action will result in a reduction in sea turtle reproduction.

Considering the size of the NWA DPS, we believe the loggerhead sea turtle population is sufficiently large enough to persist and recruit new individuals to replace those expected to be lethally taken (i.e., 16 over the course of the project). We use the following estimates to support our determination.

NMFS Southeast Fisheries Science Center (SEFSC) (2009e) estimated the likely minimum adult female population size for the western North Atlantic subpopulation in the 2004-2008 time frame to be between 20,000 and 40,000 (median 30,050) female individuals, with a low likelihood of there being as many as 70,000 individuals. The estimate of western North Atlantic adult loggerhead females was considered conservative for several reasons. The number of nests used for the western North Atlantic was based primarily on U.S. nesting beaches; as such, the results are a slight underestimate of total nests because of the inability to collect complete nest counts for many non-U.S. nesting beaches. In estimating the current population size for adult nesting female loggerhead sea turtles, NMFS SEFSC (2009e) simplified the number of assumptions and reduced uncertainty by using the minimum total annual nest count over the last 5 years (i.e., 48,252 nests). This was a particularly conservative assumption considering how the number of nests and nesting females can vary widely from year to year, (cf., 2008's nest count of 69,668 nests, which would have increased proportionately the adult female estimate to between 30,000 and 60,000). Further, minimal assumptions were made about the distribution of remigration intervals and nests per female parameters, which are fairly robust and well-known parameters.

Although not included in the NMFS SEFSC (2009e) report, in conducting its loggerhead assessment, NMFS SEFSC also produced a much less robust estimate for total benthic females in the western North Atlantic, with a likely range of approximately 60,000-700,000, up to less than 1 million. The estimate of overall benthic females is considered less robust because it is model-derived, assumes a stable age/stage distribution, and is highly dependent upon the life history input parameters. Relative to the more robust estimate of adult females, this estimate of total benthic female population is consistent with our knowledge of loggerhead life history and the relative abundance of adults and benthic juveniles: the benthic juvenile population is an order of magnitude larger than adults. Therefore, we believe female benthic loggerheads number in the hundreds of thousands.

Based on the total numbers of adult females and benthic juvenile females estimated by NMFS SEFSC for the western North Atlantic population of loggerhead sea turtles (now designated as the NWA DPS), the anticipated lethal take resulting from the proposed action (i.e., worst case, up to 16 loggerhead) represents the removal of, at most, approximately 0.043% of the estimated adult loggerhead female population. This level of lethal take of sea turtles also represents the removal of, at most, 0.0019% of the estimated female benthic loggerhead population. These removals are very small and contribute only minimally to the overall mortality on the population. Further, these percentages are likely an overestimation of the impact of the anticipated lethal take resulting from the proposed project on loggerhead sea turtles because of the following reasons. These percentages represent impacts to adult and benthic juvenile female loggerhead sea turtles only, and not to the population as a whole. Because this estimated contribution to mortality is a tiny part of our range of uncertainty across what total mortality might be for loggerhead sea turtles, we do not believe that the small effect posed by the lethal take resulting from the proposed project will be detectable or appreciable.

The potential lethal take of up to 16 loggerheads over the project will result in reduction in numbers when takes occur and possibly by lost future reproduction, but, given the magnitude of these trends and likely large absolute population size, it is unlikely to have any detectable influence on the population objectives and trends noted above. Although the effects of the proposed action will have an instantaneous effect on the overall size of the population, the action will not measurably reduce the size of the population, and will not result in an appreciable reduction in the likelihood of loggerhead sea turtles' survival in the wild.

The recovery plan for the Northwest Atlantic population of the loggerhead turtle (NMFS and USFWS 2008b) which is the same as the NWA DPS, provides additional explanation of the goals and vision for recovery for this population. The following objectives of the recovery plan are most pertinent to the threats posed by the proposed action:

- 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

The recovery plan anticipates that, with implementation of the plan, the western North Atlantic population will recover within 50-150 years, although it notes that reaching recovery in only 50 years would require a rapid reversal of the then-declining trends of the NRU, PFRU, and NGMRU.

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.

Recovery Objective No. 1, "Ensure that the number of nests in each recovery unit is increasing…," is the plan's overarching objective and has associated demographic criteria.

Currently, none of the plan's criteria are being met, but the plan acknowledges that it will take 50-150 years to do so. Further reduction of multiple threats throughout the North Atlantic, GOM, and Greater Caribbean will be needed for strong, positive population growth, following implementation of more of the plan's actions. Although any continuing mortality in what might be an already declining population can affect the potential for population growth, we believe the effects of the proposed action would not appreciably reduce the likelihood of a recovery. The potential lethal take of up to 16 loggerheads over the CHP45 project will result in reduction in numbers when takes occur and possibly by lost future reproduction, but, given the magnitude of these trends and likely large absolute population size, it is unlikely to have any detectable influence on the population objectives and trends noted above. Capture of sea turtles by relocation trawlers will not affect the adult female nesting population or number of nests per nesting season.

In conclusion, we conclude that the effects associated with the CHP45 are not expected to cause an appreciable reduction in the likelihood of the recovery of loggerhead sea turtles' (NWA DPS) recovery in the wild.

7.4 Effects of the Action on Atlantic Sturgeons' Likelihood of Survival and Recovery in the Wild

The nonlethal take of approximately 23 Atlantic sturgeon by capture relocation trawling will have no more than temporary, non-injurious effects on them. The expected lethal capture of up to 4 Atlantic sturgeon by hopper dredging, with 1-4 lethal captures of Atlantic sturgeon originating from each of the 5 DPSs (Table 9), would result in a very small reduction in numbers within each DPS, ranging from 0.00579% to 0.14749% (Table 12). These lethal interactions would also result in a reduction in their future reproduction, if some of the individuals taken would be female and would have survived other threats and reproduced in the future. With that exception, the proposed action is not likely to cause a reduction in reproduction. Atlantic sturgeon spawn in the far upstream portions of rivers which are not accessible in this area due to dams blocking access, while the CHP45 occurs in harbor and nearshore waters. Changes in the distribution of Atlantic sturgeon are also not expected from lethal takes attributed to the proposed action. Because all of the potential interactions are expected to occur at random throughout the proposed action area and Atlantic sturgeon are known to disperse widely in the marine environment, the distribution of Atlantic sturgeon in the action area is expected to be unaffected.

Table 12. Estimated percentage of Atlantic Sturgeon taken from each DPS.

DPS	Lethal Take/DPS	Population	% of population
Gulf of Maine DPS	1	7455	0.01341%
New York Bight DPS	2	34566	0.00579%
Chesapeake Bay DPS	1	8811	0.01135%
Carolina DPS	2	1356	0.14749%
South Atlantic DPS	4	14911	0.02683%

We do not believe the reductions in numbers resulting from the proposed action are likely to reduce the population's ability to persist into the future. The loss of such small numbers of individuals will not significantly decrease the overall populations of the DPSs. Based on this information, the proposed action will not appreciably reduce the likelihood of the 5 Atlantic sturgeon DPSs' survival within their ranges.

Because of the recent listing of the 5 DPSs of Atlantic sturgeon, a recovery plan for the species has not yet been developed. Recovery is the process by which listed species and their ecosystems are restored, and their future is safeguarded to the point that protections under the ESA are no longer needed. The first step in recovering a species is to reduce identified threats; only by alleviating threats can lasting recovery be achieved. An increase in the population to a size that maintains a steady recruitment of individuals representing all life stages would provide population stability and enable the population to sustain itself even in the event of unforeseen and unavoidable impacts. Major threats affecting the 5 Atlantic sturgeon DPSs were summarized in the final listing and include:

1) Dredging that can displace sturgeon while it is occurring and affect the quality of the habitat afterwards by changing the depth, sediment characteristics, and prey availability

The CHP45 project may temporarily displace sturgeon or affect the quality of habitat in the project area. However, the availability of similar available habitat in the marine environment is extensive and will provide sufficient habitat for individuals from any DPS that may be in the project area. Additionally, only adult or subadult sturgeon are expected to be in any areas affected by the CHP45 and as such are able to move throughout all habitat types without adverse impacts. While relocations of Atlantic sturgeon from each of the DPSs is expected to occur during the CHP45 project, mortality associated with the CHP45 is expected to be very low. The potential injury or mortality of 4 Atlantic sturgeon attributed to the proposed action are not likely to reduce population numbers over time due to current population sizes and expected recruitment. The use of relocation trawling will reduce the mortality of Atlantic sturgeon that occurs and increase the survival of Atlantic sturgeon that may be found in the action area for the CHP45. We therefore conclude the proposed action will not appreciably diminish the likelihood of recovery for any of the 5 DPSs of Atlantic sturgeon.

8 CONCLUSION

We have analyzed the best available data, the current status of the species, environmental baseline, effects of the proposed action, and cumulative effects to determine whether the proposed action is likely to jeopardize the continued existence of green, Kemp's ridley or the Northwest Atlantic (NWA) DPS of loggerhead sea turtles, or any DPS of Atlantic sturgeon.

8.1 Green, Kemp's Ridley, or Loggerhead (NWA DPS) Sea Turtles

Because the proposed action is not reasonably expected to reduce appreciably the likelihood of survival and recovery of loggerhead (NWA DPS), green, or Kemp's ridley sea turtles, it is our Opinion that the CHP45 is not likely to jeopardize their continued existence.

8.2 Atlantic Sturgeon

Because the proposed action is not reasonably expected to reduce appreciably the likelihood of survival and recovery of any DPS of Atlantic sturgeon, it is our Opinion that the CHP45 is not likely to jeopardize their continued existence.

9 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to Section 4(d) of the ESA prohibit take of endangered and threatened species, respectively, without special exemption. "Take" is defined as *to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct*. "Harm" is further defined by NMFS to include *significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering*. "Incidental take" is defined as *take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity*. Under the terms of ESA Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

9.1 Anticipated Amount or Extent of Incidental Take

Based on historical and recent distribution data of sea turtles and Atlantic sturgeon, hopper dredge observer reports, observations of past strandings, and increasing 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. NMFS anticipates incidental observed take will consist of a total up to 8 loggerhead, 1 green, and 2 Kemp's ridley sea turtles and 2 Atlantic sturgeon with unobserved take consisting of the same. NMFS also anticipates that capture trawling may result in up to 235 non-injurious captures and relocations of an estimated (up to) 719 loggerheads, 3 greens, 18 Kemp's ridley sea turtles, and 23 Atlantic sturgeon.

9.2 Effect of the Take

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

9.3 Reasonable and Prudent Measures

Section 7(b)(4) of the ESA requires NMFS to issue a statement specifying the impact of any incidental take on listed species, which results from an agency action otherwise found to comply with Section 7(a)(2) of the ESA. It also states the RPMs necessary to minimize the impacts of take and the terms and conditions to implement those measures, must be provided and must be followed to minimize those impacts. Only incidental taking by the federal agency that complies with the specified terms and conditions is authorized. 50 CFR 402.14(i)(2) also states that "[r]easonable and prudent measures, along with the terms and conditions that implement them, cannot alter the basic design, scope, duration, or timing of the action and may involve only minor changes."

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 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 incidental take statement. If the USACE 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, deflector draghead usage, and conditions and guidelines for relocation trawling, which NMFS believes are necessary to minimize effects 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 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, intake and overflow screening, observer and reporting requirements, and relocation trawling. The following RPMs and associated terms and conditions are established to implement these measures, document incidental takes, and specify procedures for handling individuals taken. Only incidental takes that occur while these measures are in full implementation are authorized.

1. The USACE shall implement best management measures, including the use of date-based dredging windows, sea turtle deflector dragheads, intake and overflow screening, 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.[29]

   Rationale: 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

[29] While the USACE has proposed relocation trawling activities to reduce the density of sea turtles in the path of hopper dredges, they have not stated when relocation trawling will be carried out or at what effort level. This necessitated NMFS making the decision for USACE via requirements of this biological opinion. In order to authorize take resulting from relocation trawling, NMFS must require this activity as a RPM and not as a conservation measure.

by delaying or changing the location of hopper dredge deployment in response to sea turtle density information in the channel.

2. The USACE shall have measures in place to detect and report all interactions with any protected species (ESA or Marine Mammal Protection Act) 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 detect 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. Passive Integrated Transponder (PIT) tagging, external flipper tagging, and tissue and genetic sampling of dredge- and trawl-captured turtles and sturgeon will provide important information about the animals taken during project activities. Tagging will provide information about the fate of the turtles and Atlantic sturgeon relocated should they be recaptured or strand subsequent to being relocated. Tissue sampling will identify which sea turtle and Atlantic sturgeon stocks are being impacted and their geographic origin.

9.3.1 Terms and Conditions

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). "Terms and conditions" (T&Cs) implement the reasonable and prudent measures (50 CFR 402.14). These terms and conditions must be carried out for the exemption in Section 7(o)(2) to apply.

In order to be exempt from the prohibitions of Section 9 of the ESA, the USACE must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting and monitoring requirements. These T&Cs are non-discretionary.

1) Hopper Dredging (RPM 1): Hopper dredging is allowed in accordance with the SARBO dredging window, November 1 through May 31 or outside of this period only if water temperatures are below 11°C.
2) Non-hopper Type Dredging (RPM 1): Mechanical, pipeline or hydraulic dredges, because they are not known to take turtles, must be used whenever possible.
3) Observers (RPM 2): The USACE 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, sturgeon, and their remains. Observer coverage sufficient for 100 percent monitoring (i.e., 2 observers) of hopper dredging operations is required during all hopper dredging.
4) 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), the USACE must:

a) Advise inspectors, operators, and vessel captains about the prohibitions on taking, harming, or harassing sea turtles and sturgeon.

b) Instruct the captain of the hopper dredge to avoid any turtles or sturgeon encountered while traveling between the dredge site and offshore disposal area, and to immediately contact the USACE if they are seen in the vicinity.

c) Notify NMFS immediately by email (takereport.nmfsser@noaa.gov) if a sea turtle, sturgeon, or other threatened or protected species is taken by the dredge, and reference this Opinion (F/SER/2015/15433).

5) 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.

6) 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 U.S. Coast Guard 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.

7) Sea Turtle-Deflecting Draghead (RPM 1): A state-of-the-art solid-faced deflector that is attached to the draghead with chains and an adjustable leading chain at the apex of the deflector 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 the USACE Engineering Research and Development Center (ERDC). Slotted draghead deflectors are currently not authorized.

8) Training Personnel on Hopper Dredges (RPM 1): The USACE must ensure that all contracted personnel involved in operating hopper dredges (whether privately-funded or federally-funded projects) receive thorough training on measures of dredge operation that will minimize takes of sea turtles. It shall be the goal of the hopper dredging operation to establish operating procedures that are consistent with those that have been used successfully during hopper dredging in other regions of the coastal United States, and which have proven effective in reducing turtle/dredge interactions. Therefore, 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.

9) Screening (RPM 2): When sea turtle or sturgeon 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, 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 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, because 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 Opinion - F/SER/2015/15433) by onboard NMFS-approved protected species observers, the dredging company, or the USACE within 24 hours of any sea turtle, sturgeon, or other listed species take observed.

A final report summarizing the results of the hopper dredging and any documented sea turtle, sturgeon, or other listed species takes must be submitted to NMFS (takereport.nmfsser@noaa.gov with reference to this Opinion) 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 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/seaturtleSTSSN.jsp) of the start-up and completion of hopper dredging operations and bed-leveler dredging operations and ask to be notified of any sea turtle strandings in the project area that, in the estimation of STSSN personnel, bear signs of potential draghead impingement or entrainment, or interaction with a bed-leveling type dredge.

Information on any such strandings shall be reported in writing within 30 days of project end to NMFS's Southeast Regional Office (takereport.nmfsser@noaa.gov with reference to this Opinion) 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 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. NMFS and the USACE will use these stranding reports to assess whether they suggest a greater extent of effects than predicted in this Opinion.

12) Conditions Requiring Relocation Trawling (RPM 1): The USACE shall require relocation trawling to start as soon as possible within 72 hours if either:

a) 2 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 from Section 9.1 of this Opinion.

Relocation trawling may be suspended if no relocation or dredge takes occur within 14 days unless take limits for any species have been reached.

13) Closed-net Relocation Trawling (RPM 1): Any relocation trawling conducted or contracted by the USACE 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) The net must be closed at all times during trawling.

b) 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.

c) Protected Species Handling During Trawling: Handling of sea turtles and sturgeon captured during relocation trawling in association with the dredging project shall be conducted by NMFS-approved protected species observers. Sea turtles and sturgeon captured pursuant to relocation trawling shall be handled in a manner designed to ensure their safety and viability, and shall be released over the side of the vessel, away from the propeller, and only after ensuring that the vessel's propeller is in the neutral, or disengaged, position (i.e., not rotating). Sea Turtle Research Techniques Manual is attached (Appendix A) http://www.sefsc.noaa.gov/turtles/TM_579_SEFSC_STRTM.pdf. Any handling of Atlantic sturgeon captured in the relocation trawling will comply with the attached NMFS's *Protocol for Use of Shortnose, Atlantic, Gulf, and Green Sturgeons* (Attachment B) http://www.nmfs.noaa.gov/pr/pdfs/species/kahn_mohead_2010.pdf.

d) 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 T&C No. 13-e, below.

e) Biological Data Collection: When safely possible, all sea turtles and Atlantic sturgeon shall be measured, tagged, weighed, and a tissue sample taken prior to release. Any external tags shall be noted and data recorded into the observers' log and take forms. 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. Tissue samples will be sent to NMFS for processing and analysis.

For sea turtles, collect tissue samples following the protocols above, the remaining specimen(s) or body parts of dead sea turtles must be preserved (preferably iced or refrigerated or frozen if necessary) until sampling and disposal procedures are discussed with the NMFS contact identified below. If it is not possible to retain the carcass, please scan the carcass for PIT tags and flipper tags, collect a tissue sample, and photograph the animal. Mark the carcass, if possible, and dispose of carcass near original site of capture.

Dr. Brian Stacy
NOAA/NMFS and University of Florida
2187 Mowry Road, Building 471
Gainesville, FL 32611
Brian.Stacy@noaa.gov
PH: 352-283-3370

For sturgeon, mark the carcass (in order to identify in the case of recapture), if possible, and dispose of carcass near original site of capture. Send samples, copy of Protected Species Incidental Take Form and supporting data within 1 month of the date the sample is taken.

Tim King in West Virginia
USGS Leetown Science Center, Aquatic Ecology Branch
11649 Leetown Road
Kearneysville, WV 25430
PH: 304-724-4450

f) Take and Release Time During Trawling – Turtles: Turtles shall be kept no longer than 3 hours prior to release and shall be released not less than 3 nmi from the dredge site. 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. The 3 hour holding time may be extended up to 24 hours only for sea turtles that require monitoring after resuscitation.

g) 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 shall ensure that logistical arrangements and support to accomplish this transport are pre-planned and ready. The USACE shall bear the financial cost of any subsequent treatment, rehabilitation, and release if the observer or State Sea Turtle Coordinator determines that the injuries were caused by the project.

h) Flipper Tagging: All sea turtles captured by relocation trawling shall be flipper-tagged prior to release with external tags which shall be obtained prior to the project from the University of Florida's Archie Carr Center for Sea Turtle Research. This Opinion serves as the permitting authority for any 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.

i) 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 sturgeon. Tagging of sea turtles and 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 be performed in accordance with the protocol detailed in Appendix A.

   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 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 Attachment B. Previously PIT-tagged fish must not be re-tagged.

   iv) All unmarked 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.

j) 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.

k) 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.

l) Additional Data Collection Allowed During the Handling of Sea Turtles, Sturgeon, and Other Incidentally Caught ESA-listed Species: The USACE 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 (e.g., dredging activities, relocation trawling); (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 or the USACE approves of the expense; and (4) the observer has first coordinated with USACE Charleston District and notified NMFS's Southeast Regional Office, Protected Resources Division. Limitations are as follows:

   i) Leatherback sea turtles cannot be retained and should be returned to the water as soon as possible.

   ii) In instances of hardshell sea turtle capture, observers or may retain incidentally captured animals for species research projects if the person(s) conducting the research, is on board or nearby, and 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. All additional procedures performed on retained animals must be authorized through the research permit(s). Collaborative research activities must begin within 1 hour of capture and the animal should be returned to the water within 5 hours (of time of capture). If required, animals may be held on board for up 12 hours provided that conditions during holding meet all research permit requirements and safe handling practices are followed. If research does not commence within 1 hour, the animal must be returned to the water. The intent of this provision is to minimize impacts to sea turtles by allowing, where appropriate, incidentally captured sea turtles to be used as research subjects. This reduces the need for additional animals to undergo the stress of capture associated with permitted scientific research.

14) Relocation Trawling Report (RPM 2): The USACE shall provide NMFS's Southeast Regional Office (takereport.nmfsser@noaa.gov with reference to this Opinion) 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.

10 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to, in consultation with the Services, use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations identified in Opinions can assist action agencies in implementing their responsibilities under Section 7(a)(1). Conservation recommendations are discretionary activities designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The following conservation recommendation(s) is (are) (a) discretionary measure(s) that NMFS believes is (are) consistent with this obligation and therefore should be carried out by the federal action agency:

Please notify NMFS if the federal action agency carries out any of these recommendations so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

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

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

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

4. Overflow Screening: The USACE should encourage dredging companies to develop or modify existing overflow screening methods on their company's dredge vessels for maximum effectiveness of screening and monitoring. Horizontal overflow screening is preferable to vertical overflow screening because NMFS considers that horizontal overflow screening is significantly more effective at detecting evidence of protected species entrainment than vertical overflow screening.

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

6. Section 10 Research Permits, Relocation Trawling, Piggy-Back Research, and 50 CFR Part 223 Authority to Conduct Research on Salvaged, Dead Specimens: NMFS recommends that USACE ERDC apply to NMFS for an ESA Section 10 research permit to conduct additional endangered species research on species incidentally captured during traditional relocation trawling. SERO shall assist the USACE with the permit application process.

   NMFS also encourages the USACE to cooperate with NMFS scientists, other federal agencies' scientists, and university scientists holding appropriate research permits to make more use of sea turtles and Atlantic sturgeon taken or captured by hopper dredges and relocation trawlers pursuant to the authority conferred by this Opinion. NMFS encourages "piggy-back" research projects by duly-permitted or authorized individuals or their authorized designees.

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

7. Draghead Improvements - Water Ports: NMFS recommends that the USACE require, or at least recommend, that dredge operators have all dragheads on hopper dredges contracted by the USACE for dredging projects outfitted (eventually) with water ports located in the top of the dragheads to help prevent the dragheads from becoming plugged with sediments. When the dragheads become plugged with sediments, the dragheads are often raised off the bottom by the dredge operator with the suction pumps on in order to take in enough water to help clear clogs in the dragarm pipeline, which increases the likelihood that sea turtles in the vicinity of the draghead will be taken by the dredge. Water ports located in the top of the dragheads would relieve the necessity of raising the draghead off the bottom to perform such an action, and reduce the chance of incidental take of sea turtles.

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

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

9. Sodium Vapor Lights on Offshore Equipment: On offshore equipment (i.e., hopper dredges, pumpout barges), shielded low-pressure sodium vapor lights are highly recommended for lights that cannot be eliminated when the vessels are operating with 10 mi of sea turtle nesting beaches.

11 REINITIATION OF CONSULTATION

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal action agency involvement or control over the action has been retained, or is authorized by law, and if (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this Opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this Opinion (e.g., modifications to vessel speed restrictions, using explosives for blasting or using disposal areas not considered in this Opinion), or (4) a new species is listed or critical habitat designated that may be affected by the action.

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